Addendum No. 05

May 25, 2023

Shields & Brawley Elementary School

Prepared By SIM-PBK Architects, Inc.; 7790 N. Palm Avenue; Fresno, California 93711

SIM-PBK Architects Project Number 17-67

Notice to Bidders

A. Receipt of this Addendum shall be acknowledged on the Proposal Form. Failure to acknowledge receipt of each addendum may subject bidder to disqualification.
B. This Addendum forms part of the Contract Documents for the above referenced project and shall be incorporated integrally therewith.
C. Each proposer shall make necessary adjustments and submit their proposal with full knowledge of all modifications, clarifications, and supplemental data included therein. Where provisions of the following supplemental data differ from those of the original Contract Documents, this Addendum shall govern.

GENERAL

Item No. 5-01 **BUBBLES or CLOUDS and/or DELTA 4 TAGS,** indicates changes / revisions / modifications within the document, no changes to remaining of DSA approval set.

Item No. 5-02 **All Addendums have not been approved by DSA.**

CLARIFICATIONS

Item No. 5-03 **Bid-Walk 3 Sign-in sheets**
ADDED in its entirety, see attached AD 5-03a, 5-03b,5-03c

Item No. 5-04 **OFF-SITE, CITY OF FRESNO PUBLIC WORKS PLANS, Landscape & Irrigation** Disregard verbiage on Addendum 1 Item 1-37 stating “Plans not approved by local jurisdiction”. Approval signature is shown on Addendum 1, attachment 1-37a.

SPECIFICATIONS

Item No. 5-05 **03 35 43 TOPICAL POLISHED CONCRETE SYSTEM**
ADD specification in its entirety, see attached AD 5-05a.

Item No. 5-06 **03 80 00 BOMANITE-MICRO-TOP-ST-TOPPING-SYSTEM**
The Bomanite Micro-top ST will be the base product/color. For the full system to be complete both products to be installed.
ADD specification in its entirety, see attached AD 5-06a, AD 5-06b

Item No. 5-07 **03 80 13 BOMANITE EXTERIOR BROADCAST AGGREGATE FLORSPARTIC 100 SYSTEM**
The Bomanite Florspartic will be used to create the colored sections of the compass and directional letters. For the full system to be complete

both products to be installed. **ADD** specification in its entirety, see attached AD 5-07a.

Item No. 5-08 **08 71 00 DOOR HARDWARE**
REPLACE in its entirety, see attached AD 5-08a

Item No. 5-09 **21 00 00 GENERAL FIRE PROTECTION PROVISIONS**
REPLACE in its entirety, see attached AD 5-09a.

Item No. 5-10 **21 00 01 FIRE PROTECTION SYSTEM**
REPLACE in its entirety, see attached AD 5-10a.

Item No. 5-11 **21 00 02 IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT**
ADDED in its entirety, see attached AD 5-11a.

Item No. 5-12 **21 00 02 IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT**
Fire sprinkler pipe shall have antibacterial coating. Bull Moose Eddy Guard II or approved equal.

Item No. 5-13 **22 00 00 GENERAL PLUMBING PROVISIONS**
REPLACE in its entirety, see attached AD 5-13a.

Item No. 5-14 **22 00 01 PLUMBING**
REPLACE in its entirety, see attached AD 5-14a.

Item No. 5-15 **23 00 00 GENERAL MECHANICAL PROVISIONS**
REPLACE in its entirety, see attached AD 5-15a.

Item No. 5-16 **23 00 01 GENERAL MECHANICAL PROVISIONS**
REPLACE in its entirety, see attached AD 5-16a.

Item No. 5-17 **28 16 00 INTRUSION DETECTION**
REPLACE in its entirety, see attached AD 5-17a.

DRAWINGS

Item No. 5-18 **AT&T Drawing**
ADDED in its entirety, see attached AD 5-18a

Item No. 5-19 **SHEET E4.8 ELECTRICAL ROOF PLAN**
ADDED in its entirety, see attached AD 5-19a

Item No. 5-20 **SHEET E4.9 ELECTRICAL ROOF PLAN**
ADDED in its entirety, see attached AD 5-20a

Addendum No. 05

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Item No. 5-21 **SHEET E4.10 ELECTRICAL ROOF PLAN**
ADDED in its entirety, see attached AD 5-21a

Item No. 5-22 **SHEET E4.11 ELECTRICAL ROOF PLAN**
ADDED in its entirety, see attached AD 5-22a

Item No. 5-23 **SHEET M4, MECHANICAL FLOOR PLAN, 1ST FLOOR (WEST): REPLACE** sheet in its entirely, revisions are clouded, see attached AD 5-23a.

Item No. 5-24 **SHEET M9 MECHANICAL SCHEDULES:** The cooling capacities listed on the Air Conditioning Schedule are minimum net total and sensible capacities. AC-M-1 net total capacity shall be 84.9 MBH and net sensible shall be 66.7 MBH. The AC Unit spring isolator curbs shall have pitched base to match roof slope, see Architectural and Structural drawings.

Item No. 5-25 **SHEET P2 PLUMBING FLOOR PLAN, MULTI-PURPOSE: COORDINATE** roof drain lines points of connection to Civil points of connection on C5.1 & C5.2.

Item No. 5-26 **SHEET P3 PLUMBING FLOOR PLAN, 1ST FLOOR (EAST):**
OMIT existing storm drain line and reference to see C4.1. Coordinate roof drain lines points of connection to Civil points of connection on C5.1 & C5.2.

Item No. 5-26 **SHEET P4 PLUMBING FLOOR PLAN, 1ST FLOOR (WEST): COORDINATE** roof drain lines points of connection to Civil points of connection on C5.1 & C5.2.

Item No. 5-28 **SHEET P4 PLUMBING FLOOR PLAN, 1ST FLOOR (WEST):**
UPSIZE ½" HW line to S-4 at AV 151 to a ¾" HW line. In order to complete the hot water circulating loop, add a ¾" HW line from S-4 at AV 151 and route back to Boys 137 and up to Men-2 222 (See 3/P8).

Item No. 5-29 **SHEET P4 PLUMBING FLOOR PLAN, 1ST FLOOR (WEST):**
ADD MV-1 at S-4 at AV 151.

Item No. 5-30 **SHEET P8 ENLARGED PLUMBING FLOOR PLAN, DETAIL 1: ADD** MV-1 at S-2 at Workroom 116.

Item No. 5-31 **SHEET P8 ENLARGED PLUMBING FLOOR PLAN, DETAIL 2: ADD** MV-1 at S-2 at Workroom 107.

Item No. 5-32 **SHEET P8 ENLARGED PLUMBING FLOOR PLAN, DETAIL 3:** Men-2 222 remove hot water supply line from tee to L-2. Hot water circulation (3/4" line) from WH-3 to keynote 6, down to Boys 138 (4/P8, keynote 5), out to

S-4 at AV151(see P4), back to Boys 138 then up to Men-2 222 (serves 4 lavs) and then returns to circulation pump.

Item No. 5-33 **SHEET P10 ENLARGED PLUMBING FLOOR PLAN, DETAIL 1: CHANGE** TP-1 to TP-2. Remove trap primer at 3-compartment sink. Connect the floor drain to the remaining trap primer by the prep sink.

Item No. 5-34 **SHEET P10 ENLARGED PLUMBING FLOOR PLAN, DETAIL 1: ADD** MV-1 to prep sink in front of Cool 310. Set mixing valve to max. 120° F.

Item No. 5-35 **SHEET P10 ENLARGED PLUMBING FLOOR PLAN, DETAIL 1: ADD** MV-1 to S-2 in Staff Lounge 302.

Item No. 5-36 **SHEET P11, PLUMBING DETAILS: REPLACE** sheet in its entirely, revisions are clouded, see attached AD 5-36a.

Item No. 5-37 **SHEET P12, PLUMBING SCHEDULES: REPLACE** sheet in its entirely, revisions are clouded, see attached AD 5-37a.

Item No. 5-38 **DSA Fire Sprinkler Material Data Package for reference.** See attached AD 5-38a.

Item No. 5-39 **SHEET LS.1.0, OVERALL IRRIGATION PLAN** **REVISE** EZ Flo fertigation system to EZ025-HC fertigation system and **DELETE** EZ Flo Enclosure. **Add** Concrete valve box and steel lid. see attached AD 5-39a.

Item No. 5-40 **SHEET LS.5.1, IRRIGATION & PLANTING DETAILS** **REVISE** EZ Flo fertigation installation at booster pump enclosure. **REPLACE** EZ Flo fertigation detail with new fertigation detail 'I / LS 5.1'. see attached AD 5-40a.

Item No. 5-41 **SHEET LS.4.2, IRRIGATION & PLANTING DETAILS** **DELETE** decomposed granite surfacing indicated for installation in six (6) tree wells at the south side of the service yard. **Add** Six (6) cast iron tree grates and frames at tree wells south of the service yard. Provide tree grates in size to fit tree well, natural finish. See attached AD 5-41a.

END OF ADDENDUM

MANDATORY PRE-BID WALK
SIGN-IN SHEET

AD 5-03a
S&B Elemenatary
02-116800

DATE: Tuesday, May 23, 2023
LOCATION: The address is: 4108 West Shields Avenue, Fresno, California 93722.
We will meet on the 4000 block of Fountain Way (west of Brawley Avenue) in front of the site
PROJECT: Shields and Brawley Elementary School
TIME: 10:00AM

PLEASE WRITE CLEARLY & LEAVE BUSINESS CARD

BID Package #	Print Name	Company / Firm	Phone No.	Email Address
SB 1	JAVIER GARCIA	Terra West Construction	559-348-1086	estimating@terrawestconstruction.com
SB 3	John Powers	Graham Pestwett inc	559-291-3741	John@GPI ROOFING.com
SB 4	Garrett Nolan	EB Landscape	559-801-4715	Devin@EBlandscapeconstruction.com
SB 5	Jason Abraham	Johnson Controls Fire	559-250-7997	Jason.Abraham@JCI.com
	Elizabeth Espinoza	Kitchell	559-360-8250	eespinoza@kitchell.com
	Liz Gonzalez	Kitchell	559 232-7401	lgonzalez@kitchell.com

MANDATORY PRE-BID WALK
SIGN-IN SHEET

AD 5-03b
S&B Elemenatary
02-116800

DATE: Tuesday, May 23, 2023
LOCATION: The address is: 4108 West Shields Avenue, Fresno, California 93722.
We will meet on the 4000 block of Fountain Way (west of Brawley Avenue) in front of the site
PROJECT: Shields and Brawley Elementary School
TIME: 10:00AM

PLEASE WRITE CLEARLY & LEAVE BUSINESS CARD

BID Package #	Print Name	Company / Firm	Phone No.	Email Address
Roofing	Victor Maravilla	Nations Roof	(559) 341-8640	vmaravilla@nationsroof.com
SB-5	Bruce Jordan	Fire System Solutions	(559) 275-4894	BJORDAN@FIRESYSTEMSOLUTIONS.COM
1	Alan Johnson (for Ross Jenkins)	American Paving Co.	559-268-9866	estimating@americanpavingco.com

MANDATORY PRE-BID WALK
SIGN-IN SHEET

DATE: Tuesday, May 23, 2023
LOCATION: The address is: 4108 West Shields Avenue, Fresno, California 93722.
We will meet on the 4000 block of Fountain Way (west of Brawley Avenue) in front of the site
PROJECT: Shields and Brawley Elementary School
TIME: 10:00AM

AD 5-03c
S&B Elemenatary
02-116800

PLEASE WRITE CLEARLY & LEAVE BUSINESS CARD

BID Package #	Print Name	Company / Firm	Phone No.	Email Address
	MATT PATNAUDE	MATSON ALARM	559-417-0594	MPATNAUDE@MATSONALARM.COM
	Mike Reitz	MATSON ALARM	559-267-6458	mike.reitz@matsonalarm.com
SB-2	GREG PERHAM	MARKO CONSTRUCTION	559-222-7888	GPERHAM@MARKOCONSTRUCTION.COM
SB-12	PAUL GONG	IRONBY DESIGN	559-222-7888	PKGONG@MARKOCONSTRUCTION.COM

AD 5-05a
S&B Elemenatary
02-116800

SECTION 03 35 43

TOPICAL POLISHED CONCRETE SYSTEM

PART 1 - PART I – GENERAL

1.1 SECTION INCLUDES:

A. Products and procedures for the installation of the ULTRAFLOR® DIAMATIC® Polished Concrete System using a multi-step dry mechanical process and accessories indicated, specified or required to complete system and achieve specified finish:

1. DIAMATIC® Mechanical Diamond Grinding and Polishing Equipment

2. ULTRAFLOR® DIAMATIC® Concrete Treatment Chemicals

B. ULTRAFLOR® DIAMATIC® Topical Polished Concrete System is a finish that is part of the ULTRAFLOR® DIAMATIC® Polished Concrete System.

C. Products and procedures for the initial and long term maintenance of the ULTRAFLOR® DIAMATIC® Topical Polished Concrete System.

D. All equipment, diamond products, concrete repair and topping materials, crack and joint treatments and chemicals are specified by DIAMATIC® Management Services.

1.2 SUBMITTALS

A. Product Data: Submit Manufacturer’s technical literature for each product indicated, specified or required. Include manufacturer’s technical data, application instructions, recommendations and MSDS.

1. Installer Qualifications: Data for company, principal personnel, experience, and training. Provide a letter documenting installer’s accreditation and certification compliance, as specified under quality assurance.

1.3 QUALITY ASSURANCE / WARRANTY

A. Manufacturer Qualifications: The ULTRAFLOR® DIAMATIC® Polished Concrete System consists of a process and products engineered and manufactured by DIAMATIC®. Any substitutions are not permitted and void warranty.

1. Installer Qualifications:

a. Installer must be an DIAMATIC® ELITE installer for the ULTRAFLOR® Polished Concrete System, including the use of DIAMATIC® equipment and diamond abrasives, and DIAMATIC® concrete preparation, joint treatment, and chemical hardening and finishing materials.

b. Installer must be experienced in performing specified work similar in design, products and scope of this project, with a documented track record of successful, in-service performance and with sufficient production capabilities, facilities and personnel to produce specified work.

c. A factory-trained, competent supervisor must be maintained on site during all times during which specified work is performed.

d. Installer must provide written documentation from the manufacturer confirming the Installer's current accreditation and training from DIAMATIC® on installation of the ULTRAFLOR® DIAMATIC® Polished Concrete System and related equipment and processes. Failure to provide current accreditation will void any warranty implied or otherwise associated with the ULTRAFLOR® System.

e. A current list of qualified installers may be obtained through DIAMATIC MANAGEMENT SERVICES, DIAMATIC USA 866-295-5512

2. Mock-Up: Before performing the work in this section, an adequate on-site mock-up of the ULTRAFLOR® DIAMATIC® Polished Concrete System representative of specified process, surface, finish, color and joint design/treatments must be installed for review and approval. These mock-ups should be installed using the same Installer personnel who will perform work. Approved mock-ups may become part of completed work, if undisturbed at time of substantial completion.

3. Static Coefficient of Friction: A reading of not less than 0.5 for level floor surfaces shall be achieved and documented, as determined by certified an NFSI walkway auditor using the NFSI 101-A quality control test.

4. Test Reports: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Owner and/or Architect. All test data shall be recorded and submitted upon completion of job.

a. Section 03 30 00, Cast-In-Place Concrete

b. ASTM E1155, Standard Test Method for Determining Floor Flatness and Levelness using the F number system

c. ASTM E430, Standard Test Method for Measurement of Gloss of High-Gloss Surfaces by Abridged Goniophotometry

d. ACI 302 1 R-04 Guide for Concrete Floor and Slab Construction

5. Pre-Installation Conference: Prior to the installation of the ULTRAFLOR® DIAMATIC® Polished Concrete System, an on-site conference shall be conducted to review specification requirements.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in original containers, bearing manufacturer's labels indicating brand name and directions for storage, factory numbered and sealed until ready for installation.

B. Maintain records of product container numbers.

C. Store all materials in a dry, climate-controlled environment at a minimum of 55°F (13°C) and maximum of 85°F (29°C).

1.5 SITE CONDITIONS

A. Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation and other conditions affecting the floor finish.

B. Close areas to traffic during and after ULTRAFLOR® DIAMATIC® Topical Polished Concrete System application for a time period recommended by the manufacturer.

C. Inspect the existing substrate and document unsatisfactory conditions in writing. Verify that surfaces and site conditions are ready to receive work. Correct unacceptable conditions prior to installation of System. Commencement of work constitutes acceptance of substrate conditions.

D. Existing concrete must be cured for a sufficient time period recommended by DIAMATIC® before the application can begin.

E. Protect existing concrete and the new ULTRAFLOR® DIAMATIC® Topical Polished Concrete System from contamination by petroleum, oil, hydraulic fluid, acid and acidic detergents, paint and other liquid dripping from trades and equipment working over these substrates. If construction equipment must be used on these substrates, diaper all components that may drip fluids.

F. Prohibit vehicle parking and pipe cutting operations over existing concrete and the new ULTRAFLOR® DIAMATIC® Topical Polished Concrete System.

G. Moisture Vapor Testing

1. Test existing concrete for moisture vapor transmission according to methods indicated in ASTM F1869. Acceptable results: not more than 5 pounds per 1,000 square feet in 24 hours.

2. Test existing concrete for relative humidity using in situ probes according to ASTM F2170. Acceptable results: not more than 80%.

PART 2 - PART 2 – PRODUCTS

2.1 SYSTEM

A. BASIS OF DESIGN:

1. The ULTRAFLOR® DIAMATIC® Topical Polished Concrete System is an engineered and integrated complete installation system requiring strict adherence to all specified installation processes, equipment, diamond abrasives, concrete preparation, joint treatment and chemicals to achieve the intended result. Any substitutions from the specified products and/or processes will void the system warranty.

2. Subject to compliance with requirements, provide alternate system as required by Division 01. Alternates must be by one manufacturer to create an alternate complete system (no exception).

B. EQUIPMENT

1. DIAMATIC® Micro Polisher MPS-1727 - Burnisher: Specific weight and RPM are required to reach temperature of 100˚F for application of FLOR-FINISH application.

2. DIAMATIC® 5” Low Speed Grinder: Hand Held Polishing Tool: 5” hand floor polisher for edges with variable speed control range of 500 – 2200 RPM.

3. Vacuums: Dust Collection must be designed for filtering of concrete dust. Minimum air speed of 300 CFM for Large and Medium Platform equipment.

4. DIAMATIC® BDC1324, BDC-1330BDP, BDC3140P.

5. DIAMATIC® Diamond Abrasives and Blades

a. Hybrid Flex-res Resin Bonded Diamonds – 50, 100, 200 Grit.

b. FLOR-GRIT Diamond Impregnated Pads – 200, 400, 800 Grit.

C. CONCRETE TREATMENT CHEMICALS

1. DIAMATIC® FLOR-SIL™ Lithium Densifier for standard concrete and terrazzo surfaces

2. DIAMATIC® FLOR-COLOR™ Micronized Water Borne High Performance Dye

3. DIAMATIC® FLOR-FINISH Stain and Wear Protection Treatment (high-gloss) Powered by Dow Corning.

4. DIAMATIC® FLOR-FINISH-L Stain and Wear Protection Treatment (low-gloss) Powered by Dow Corning

5. DIAMATIC® FLOR Maintainer™ Gloss, Stain and Wear Protection Routine Maintenance Treatment

6. DIAMATIC® PROTECTION MATERIALS

a. To prevent minor damage from light trade traffic during build out of site, DIAMATIC® ECONO-COVER Protective Floor Covering for the ULTRAFLOR® DIAMATIC® Polished Concrete System shall be installed or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect all concrete substrates and conditions under which the ULTRAFLOR® DIAMATIC® Burnished Concrete System to be installed.

B. Verify that all surfaces and site conditions are ready to receive work; document and correct conditions detrimental to timely and proper installation of work. Beginning work constitutes acceptance of substrate condition.

C. Verify that existing concrete has cured a minimum of 28 days and meets finish and surface profile requirements in Division 03 Section “Cast-In-Place Concrete,” before installing the ULTRAFLOR® DIAMATIC® Topical Polished Concrete System.

D. Conduct pre-installation conference, per Section 1.3 F.

3.2 PREPARATION

A. CONCRETE REPAIR

1. Joint Fill (Indoor)

a. All joint fill materials shall be installed in accordance with the written recommendations provided in the manufacturer’s technical brochures.

b. For the best results all joints should be filled after the first pass of the FLOR-GRIT diamond impregnated pad, but before any further polishing continues.

c. Prior to filling joints, repair badly spawled joint edges per ACI 302.1R-04.
1) Grind the outside edges of all spalls to eliminate any feathered edges and make sure that the minimum depth of the spall is ½”. Mechanically prepare the joint area, and chip out any concrete less than ½” in depth.

3.3 GLOSS ATTAINMENT (ASTM E430)

A. Gloss readings are not to be obtained through the use of any microfilming products, sealers, coatings, enhancers or as the result of resin transfer from resin bond abrasives.

B. Readings shall be taken not less than 10’ (3 m) on center in field areas and within 1’ (0.3 m) of floor area perimeters. In no case shall a reading be below 2% of specified minimum sheen:

1. Level A Sheen – Low Gloss reading of 30 to 40. 400 grit diamond finish.

2. Level B Sheen – Medium Gloss reading of 41 to 55. 800 grit diamond finish.

3. Level C Sheen – High Gloss reading of 56 or higher. 1500 grit or higher.

C. For instructions on achieving gloss levels, refer to the appropriate sub-section of section 3.04 below.

3.4 POLISHING

A. Use the grinding and polishing steps outlined below to install the Topical Polished Concrete finish. Depending on the condition of the floor the first pass may be the 50 or 100 grit Flex-Res resin bonded abrasive. Topical polished concrete is a topical finish designed to polish the existing cement paste without any significant exposure of the surface aggregates.

B. LEVEL B Medium Gloss / TOPICAL POLISHED CONCRETE FINISH (NEW CONSTRUCTION)

1. Clean surface thoroughly to remove any marks or stains from the surface.

2. POLISH #1: 200 grit FLOR-GRIT PAD on a DIAMATIC MPS-27 with weights.

a. Misting the surface with water during the operation will clean the surface well.

b. Broom and vacuum the floor to remove all residual dust.

c. If required, apply APROVED GROUT to fill areas in need of minor repair.

d. Application details

1. Apply DIAMATIC FLOR-SIL™, per application instructions at a rate of 400 square feet per gallon.

2. Allow FLOR-SIL™ to dry for 1 hour before continuing onto the next step.

3. POLISH #2: 400 FLOR-GRIT PAD on a DIAMATIC MPS-27 with weights.

    a. Additional FLOR-GRIT PADS may be used for further refinement 800-1500-3000

    b. Broom and vacuum floor to remove dust.

    c. Apply DIAMATIC FLOR-FINISH™ (High gloss) per application instructions at a rate of 2,500 square feet per gallon.

    d. Allow to dry a minimum of 15-30 minutes.

4. MICROPOLISH/BURNISH #2: FLOR-GRIT® 800 Grit Diamond Impregnated Pad.

    a. Dry mop the floor clean to remove all debris.

    b. Apply FLOR-FINISH™ (High gloss) per application instructions at a rate of 3,000 square feet per gallon at 90 degrees to the first coat.

    c. Allow to dry a minimum of 15-30 minutes.

5. MICROPOLISH/BURNISH #3: FLOR-GRIT® 1500 Grit Diamond Impregnated Pad.

3.5 EDGES

A. Where desired, polished edge work of all areas shall be done with a 5” or 7” DIAMATIC Hand Held or Walk Behind polishing tool. The edge polishing process will match the corresponding steps outlined above for the desired gloss level, and each edge polishing step shall be done immediately after the matching main polishing step.

B. NOTE: All grinding and polishing completed with grinder/polisher equipment connected to a dust collector.

3.6 ACCEPTANCE

A. Remove all installation materials and any foreign materials resulting from the installation, from the site.

B. Clean adjacent surfaces and materials.

C. Perform post job walk to ensure that the ULTRAFLOR Concrete System has been completed per the process spec.

D. Take pictures of final product for documentation and submittal, if requested or required.

3.7 PROTECTION

A. Prevent any spills or stains from coming into contact with the floor. Clean any spills that may occur as quickly as possible.

B. **Avoid moisture for 72 hours after installation.** Don't permit standing water for this period or place any protective plastic sheeting, rubber matting, rugs or furniture that can prevent proper drying, thereby trapping moisture, which can result in a cloudy effect on the floor. Refer to product technical data sheet for complete details and requirements.

C. Protect the finished ULTRAFLOR® DIAMATIC Topical Polished Concrete System from continuing construction and build out as needed by installing the DIAMATIC ECONO-COVER Protective Floor Covering or AN APROVED EQUAL Protective Floor Covering.

1. The installation of the DIAMATIC Protective Covering must be approved by the Installer and General Contractor of the ULTRAFLOR® installation.

2. If the DIAMATIC Protective Cover is damaged during use, then that section must be cut out and replaced to maintain the integrity of the protective covering.

3. The DIAMATIC Protective Cover can be removed after build out is complete.

3.8 ONGOING MAINTENANCE

A. Restrict using water on the surface for 72 hours after initial installation. The surface should not be cleaned using a string mop for 60 days to avoid streaking of the FLOR-FINISH. Avoid using mats or treated coverings for a minimum of 14 days to allow the finish to fully cure.

B. DO NOT USE cleaners that are acidic or have citrus (de-limonene) or butyl compounds. Although the ULTRAFLOR® DIAMATIC Polished Concrete System is chemical and stain resistant, the application of these high acid cleaners may etch the surface and cause a residual stain. Regular maintenance and cleaning will help prolong surface shine.

3.9 DAILY MAINTENANCE

A. Once the system is fully cured out (min. 72 hours), routinely sweep, dry mop, use of a high quality micro-fiber dust mop is the best method. A neutral pH cleaner only may be used when soils or stains must be removed. Any standing water should be removed immediately after cleaning.

B. An auto-scrubber may be used if equipped with a vacuum system to remove any standing water. The equipment tank should be filled with clean water only, NO CHEMICALS. The scrubber should be equipped with a soft pad only, DO NOT USE A BRUSH attachment.

3.10 WEEKLY MAINTENANCE

A. An auto-scrubber may be used if equipped with a vacuum system to remove any standing water. The equipment tank should be filled with clean water only, NO CHEMICALS. The scrubber should be equipped with a soft pad only, DO NOT USE A BRUSH attachment.

B. Use of a BURNISHER equipped with a FLOR-GRIT pad may be used as needed to restore gloss to specified levels. An 800 or 1500 grit pad is recommended.

3.11 EXTENDED MAINTENANCE

A. After thorough cleaning a coat of the DIAMATIC FLOR-MAINTAINER may be applied to restore original gloss and increase the stain resistance on the surface. Follow all technical data instructions for proper application or consult the original floor installer for assistance.

B. Use of a BURNISHER equipped with a FLOR-GRIT pad may be used after the application of the FLOR-MAINTAINER to restore gloss to specified levels. An 800 or 1500 grit pad is recommended.

END OF SECTION – 03 35 43

AD 5-06a
S&B Elemenatary
02-116800

SECTION 03 80 00

OUTDOOR (COMPASS) CONCRETE FINISHES
Micro-Top ST Topping System

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.2 SUMMARY

A. Design Work base specified in this section includes all labor, materials, equipment and services necessary to complete the Bomanite Micro-Top ST Topping System or equal including surface preparation, primers, cementitious topping, and surface treatments.

B. Related Sections include the following:

1. Division 1 Section “Product Requirements” for submittals and substitutions.

2. Division 3 Section “Joint Sealers” Installation of caulking if required

1.3 SUBMITTALS

A. Product Requirements:

1. Provide submittal information within 15 calendar days after the contractor has received the owner's notice to proceed.

B. Product Data:

1. Submit Bomanite specifications, test data (if applicable) and other data required for each type of manufactured material and product indicated.

2. Submit Bomanite Technical Bulletins listing product name, descriptive data, curing time and application requirements.

3. Submit Bomanite Safety Data Sheet (SDS) and other safety requirements.

C. Field quality-control test and inspection reports.

1. Documentation by the Bomanite contractor of adequate surface profile prior to installation.

2. Moisture tests of the concrete to be topped resulting in a reading of 85% or greater relative humidity are unacceptable for this type of installation. Consult with the Bomanite installer or Bomanite Technical Services on an appropriate system designed to suppress the moisture prior to installation.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: The contractor for this work shall be a Bomanite Toppings System Dealer and Certified Applicator approved by Bomanite Company (303) 369-1115.

1. Provide letter of certification from Bomanite Company stating that installer is a certified applicator of special concrete finishes and is familiar with proper procedures/installation requirements of the manufacturer.

2. Applicator shall be familiar with the specified requirements and the methods needed for proper performance of work of this section.

3. Applicator shall be familiar with previously supplied project samples and have constructed mock-ups approved by the architect that demonstrate standard of workmanship.

4. Authorized Bomanite Toppings System installers limited to the following:

a. http://bomanite.com/find-licensed-contractors/
b.For additional assistance in locating an Authorized Bomanite Toppings Systems contact imagine@bomanite.com

B. Manufacturer Qualifications: A firm experienced in the support and training of a national installer network and manufacturing products required/listed to complete the work.

1. Bomanite Company (303) 369-1115– no equal

C. Source Limitations:

1. Micro-Top ST related materials: Obtain each type of material of the same brand from one source from a single manufacturer.

2. Do not interchange manufactured materials within the Micro-Top ST systems as all warranties whether expressed or implied will be null and void.

D. Mock-ups:

1. Apply finish to mock-ups constructed by Bomanite Certified Applicator, using each type of finish to demonstrate finished appearance and standard of workmanship.

a. Mock-up shall include entire system, including surface preparation, primers, cementitious basecoat, cementitious topcoat, expansion/isolation joints and surface treatments.

b. Notify Architect seven days in advance of dates and time when mock-ups will be constructed.

c. Obtain from Architect approval of mock-ups before starting construction.

d. If the Architect determines that the mock-ups do not meet requirements, General Contractor will demolish and remove them from the site and arrange to assemble more until approved.

e. Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed work.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing Bomanite or Bomanite approved labels indicating brand name and directions for storage, mixing with other components and application.

B. Store materials to comply with Bomanite written instructions to prevent deterioration from moisture or other detrimental effects.

C. Dispense special concrete finish material from Bomanite factory numbered and sealed containers. Maintain record of container numbers.

1.6 PROJECT CONDITIONS

A. Environmental Limitations:

1. Comply with Bomanite written instructions for ambient temperature and other conditions affecting installation performance.

2. Concrete must be cured a minimum of 14 days or as directed by the manufacturer before installation of Bomanite Micro-Top ST can begin.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce products, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering materials required to be incorporated into the work include, and are limited to, manufacturer listed.

a. Bomanite Company (303) 369-1115 www.bomanite.com

2.2 MATERIALS

A. Bomanite Micro-Top ST: A cementitious topping comprised of powders in multiple gradations, field added vinyl versatate based polymer admixtures and other modifiers designed for a resilient coating.

B. Bomanite Hydrolock: A semi-penetrating epoxy modified sealer with minimal residual surface sheen designed to protect cementitious surfaces.

C. No substitutions or alternates to the above will be accepted.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Consult the General Contractor, Structural Engineer, Architect and Pre-Cast Contractor with Bomanite installer present prior to casting the concrete to which the Micro-Top ST is to be applied to. Ensure complete understanding of substrate preparation, finishing, bond breakers or release agents, penetrations, expansion joints, moisture content etc.

B. Examine previously cast concrete prior to installation with Bomanite installer present for conditions affecting performance of the Micro-Top ST. Rectify conditions detrimental to timely and proper work . Do not proceed with installation of Micro-Top ST until unsatisfactory conditions are corrected.

3.2 SURFACE PREPARATION

A. Mechanically profile the concrete slab with planetary head grinders, hand held grinders, shotblasting equipment, sandblasting (or other media deemed appropriate) or high pressure water cleaning equipment to ICRI CSP 1 or greater.

3.3 INSTALLATION

A. Apply the Micro-Top ST via four step spray application according to the manufacturers proprietary internal application procedures including field mixed primer, cementitious basecoat, cementitious topcoat and penetrating sealer.

B. Application will have mockup present during installation to judge quality of workmanship and finished appearance.

3.4 JOINTING

A. Expansion Joint Caulking: Joint caulking to be installed after the Micro-Top ST installation is complete.
B. All joints are to be diamond saw cut clean at transition or masked appropriately to have a relatively smooth and straight transition to caulking.
C. Use a two component polyurethane or equal in a color complimentary to the Micro-

Top ST System color.

3.5 PROTECTION

A. General Contractor’s responsibility to provide and install protection according to Bomanite installer’s recommendations. Protection of the finished surface is to be maintained by the General Contractor until substantial completion of the project is met.

END OF SECTION

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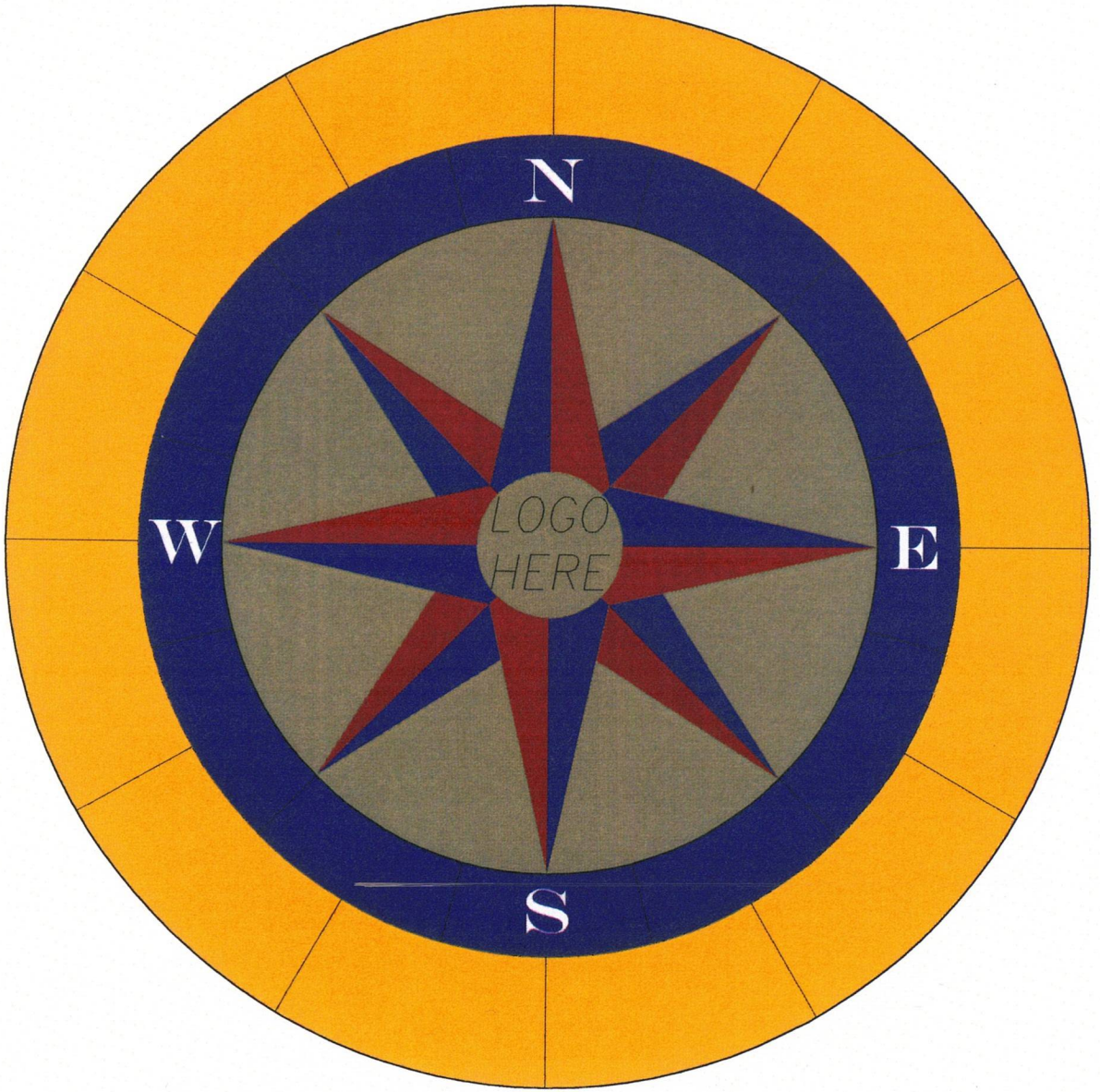

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SECTION 03 80 13

OUTDOOR (COMPASS) CONCRETE FINISHES
BROADCAST AGGREGATE EXTERIOR FLORSPARTIC 100 FLOORING SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.2 SUMMARY

A. Design Work base specified in this section includes all labor, materials, equipment and services necessary to complete the proprietary Bomanite Broadcast Aggregate System or equal including surface preparation, primers, aggregate and surface treatments.

B. Related Sections include the following:

1. Division 1 Section “Product Requirements” for submittals and substitutions.

2. Division 3 Section “Cast-in-Place Concrete” for concrete slabs.

3. Division 3 Section “Joint Sealers” Installation of caulking if required

1.3 SUBMITTALS

A. Product Requirements:

1. Provide submittal information within 35 calendar days after the contractor has received the owner's notice to proceed.

B. Product Data:

1. Submit Bomanite specifications, test data and other data required for each type of manufactured material and product indicated.

2. Submit Bomanite Technical Bulletins listing product name, descriptive data, curing time and application requirements.

3. Submit Bomanite Safety Data Sheet (SDS) and other safety requirements.

C. Field quality-control test and inspection reports.

1. Documentation by the Bomanite contractor of existing concrete condition and deficiencies prior to installation.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: The contractor for this work shall be a Bomanite Toppings System Licensee Licensed and Certified Applicator approved by The Bomanite Company
(303) 369-1115 or imagine@bomanite.com.

1. Provide letter of certification from The Bomanite Company stating that installer is a certified applicator of special concrete finishes and is familiar with proper procedures/installation requirements of the manufacturer.

2. Use an authorized Bomanite Licensee and adequate number of skilled workmen who are thoroughly trained and experienced in the necessary craft.

3. Applicator shall be familiar with the specified requirements and the methods needed for proper performance of work of this section.

4. Applicator shall be familiar with the previously approved samples and mock-ups that demonstrated standard of workmanship.

5. Authorized Bomanite Toppings System installers limited to the following:

a. www.bomanite.com/locate/ or approved by The Bomanite Company

B. Manufacturer Qualifications: A firm experienced in the support and training of a national installer network and manufacturing products required/listed to complete the work.

1. The Bomanite Company 303-369-1115 – no equal

C. Source Limitations:

1. Broadcast Aggregate Flooring System related materials: Obtain each type of material of the same brand from one source from a single manufacturer.

2. Do not interchange manufactured materials within the Broadcast Aggregate Flooring System as all warranties whether expressed or implied will be null and void.

D. Mock-ups:

1. Apply finish to mock-ups constructed by Bomanite Licensed Installer, using each type of finish to demonstrate finished appearance and standard of workmanship.

a. Mock-up shall include entire system, including surface preparation, primers, aggregate, expansion/isolation joints and surface treatments.

b. Notify Architect seven days in advance of dates and time when mock-ups will be constructed.

c. Obtain from Architect approval of mock-ups before starting construction.

d. If the Architect determines that the mock-ups do not meet requirements, General Contractor will demolish and remove them from the site and arrange to assemble more until approved.

e. Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed work.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing Bomanite or Bomanite approved vendor labels indicating brand name and directions for storage, mixing with other components and application.

B. Store materials to comply with Bomanite written instructions to prevent deterioration from moisture or other detrimental effects.

C. Dispense special concrete finish material from Bomanite factory numbered and sealed containers. Maintain record of container numbers.

1.6 PROJECT CONDITIONS

A. Environmental Limitations:

1. Comply with Bomanite written instructions for ambient temperature and other conditions affecting installation performance.

2. Concrete must be cured a minimum of 14 days or as directed by the manufacturer before installation of Bomanite Broadcast Aggregate System can begin.

1.7 PERFORMANCE REQUIREMENTS

A. The system is required to resist water intrusion indefinitely provided no structural movement has compromised the system.

B. The system is required to have a clear non-yellowing high-performance coating applied as a topcoat with a non-slip finish.

C. The system is required to have resistance to common solvents.

D. The system is required to suppress moisture and alkalinity for exterior use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce products, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering materials required to be incorporated into the work include, and are limited to, manufacturer listed.

a.The Bomanite Company (303) 369-1115 www.bomanite.com

2.2 MATERIALS

A. Bomanite Florspartic 100 Gloss: A topically applied 100% solids Polyaspartic coating designed to be applied to correctly prepared wood, concrete and engineered cementitious products along with manufacturer approved epoxies.

B. AC Tech Epoxy Primer (or equal): 100% solids epoxy primer designed for exterior applications where moisture and alkalinity must be suppressed prior to the installation of a non-breathable high-performance coating or topping.

B. Broadcast Aggregate: Factory colored and field blended UV stable sub-angular quartz aggregates.

C. No substitutions or alternates to the above will be accepted.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Consult General Contractor, Structural Engineer, Architect and Concrete Contractor with Bomanite installer present prior to pouring the concrete slab to which the Bomanite Broadcast Aggregate System is to be applied to. Ensure complete understanding of substrate preparation, vapor barrier installation, control joint placement, penetrations, mechanical bases, slope to drains etc.

B. Examine slab prior to installation with Bomanute installer present for conditions affecting performance of the Bomanite Broadcast Aggregate System. Rectify conditions detrimental to timely and proper work . Do not proceed with installation of Bomanite Broadcast Aggregate System until unsatisfactory conditions are corrected.

C. Repair of defective portions of concrete slab due to improper installation is the responsisbility of the Bomanite installer. All repairs must meet the satsifaction of the architect.

3.2 SURFACE PREPARATION

A. Mechanically profile the concrete slab with planetary head grinders and hand held grinders to International Concrete Repair Institute Concrete Surface Profile 2 standards or greater.

B. Treat all cracks and control joints with a semi-rigid penetrating polyurea or equal two component product in a manner consistent with the repair product manufacturer's guidlines. Grind the repair flush to the concrete slab prior to the Bomanite Broadcast Aggregate System installation.

C. Construction and Contraction/Expansion/Isolation Joints:
   1. If necessary clean joints mechanically using hand held or walk behind grinders with crack chasing type blade after substantial completion of the Bomanite Broadcast Aggregate System.
   2. Fill all joints with a flexible polyurethane joint filler in a manner consistent with the repair product manufacturer's guidelines.

3.3 INSTALLATION

A. Apply the Bomanite Broadcast Aggregate System according to the manufacturers proprietary internal application procedures including prime coats, pigmented basecoats, aggregate, clear topcoat and joint fillers.

B. Coat perimeter of room and mechanical bases a minimum of 4" up the vertical faces (optional and requires the use of preformed cove base).

3.4 PROTECTION

A. It is the General Contractor's responsibility to provide and install protection according to Bomanite installer's recommendations. Protection of the finished surface is to be maintained by the General Contractor until substantial completion of the project is met and the floor can go into service.

END OF SECTION

SECTION 08 71 00 - DOOR HARDWARE

AD 5-08a
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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions of Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.

B. This Section includes the following, but is not necessarily limited to:
1. Door hardware, including electric hardware.
2. Storefront and Entrance door hardware.
3. Card reader access control devices.
4. Power supplies for electric hardware.
5. Thresholds, gasketing and weather-stripping.

C. Related Sections: The following sections are noted as containing requirements that relate to this Section, but may not be limited to this listing.
1. Division 08: Section - Hollow Metal Doors and Frames.
2. Division 08: Section - Wood Doors.
3. Division 08: Section - Aluminum-Framed Storefronts.
4. Division 28: Section - Electronic Access Control and Fire/Life-Safety Systems.

1.3 REFERENCES

A. 2019 California Building Code, CCR Title 24, Part 2

B. BHMA - Builders' Hardware Manufacturers Association

C. DHI - Door and Hardware Institute

D. NFPA - National Fire Protection Association.
1. NFPA 80 - Fire Doors and Other Opening Protectives
2. NFPA 105 - Smoke and Draft Control Door Assemblies

E. UL - Underwriters Laboratories.
1. UL 10C - Fire Tests of Door Assemblies
2. UL 305 - Panic Hardware

F. WHI - Warnock Hersey Incorporated

G. SDI - Steel Door Institute

1.4 SUBMITTALS & SUBSTITUTIONS

A. General: Submit in accordance with Conditions of the Contract and Division 01 Specification sections.

B. Submit product data (catalog cuts) including manufacturers' technical product information for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.

C. Submit electronic PDF copies of schedule organized vertically into “Hardware Sets” with index of doors and headings, indicating complete designations of every item required for each door or opening. Include following information:
   1. Include a Cover Sheet with:
      a. Job Name, location, telephone number.
      b. Architects name, location and telephone number.
      c. Contractors name, location, telephone number and job number.
      d. Suppliers name, location, telephone number and job number.
      e. Hardware consultant's name, location and telephone number.
   2. Job Index information included:
      a. Numerical door number index including; door number, hardware heading number and page number.
      b. Complete keying information (referred to DHI hand-book "Keying Systems and Nomenclature"). Provision should be made in the schedule to provide keying information when available; if it is not available at the time the preliminary schedule is submitted.
      c. Manufacturers' names and abbreviations for all materials.
      d. Explanation of abbreviations, symbols, and codes used in the schedule.
      e. Mounting locations for hardware.
      f. Clarification statements or questions.
      g. Catalog cuts and manufacturer’s technical data and instructions.
   3. Vertical schedule format sample:

Heading Number 1 (Hardware group or set number - HW Group #1)				
(a) 1 Single - Door #101 - Corridor 101 to Exterior			(b) 90°	(c) RH
(d) 3'-0" x 7'-0" x 1-3/4" - Wood Door x Hollow Metal Frame - 20 Minute				
(e) 1.	(f) 3 ea	(g) Hinges - (h) 5BB1 4.5 x 4.5 NRP (i) 1/2 TMS	(j) 630	(k) IVE
2.	1 ea	Lockset - ND80P6D x RHO x RH x 10-025 x JTMS	626	SCH
3.	1 ea	Closer - 4040XP x EDA x TBSRT	689	LCN

(a) Single or pair of doors with opening number and location.
(b) Degree of opening.
(c) Hand of door(s).
(d) Door/frame dimensions and material; Label requirements, if any.
(e) Hardware item line # (Optional).
(f) Quantity.
(g) Product description.
(h) Product part number.
(i) Fastenings and other pertinent information.
(j) Hardware finish codes per ANSI/BHMA A156.18.
(k) Manufacturer abbreviation.

D. Make substitution requests in accordance with Division 01. Substitution requests must be made prior to bid date. Include product data and indicate benefit to the project. Furnish samples of any proposed substitution.

E. Wiring Diagrams: Provide product data and wiring and riser diagrams for all electrical products listed in the Hardware Schedule portion of this section.

F. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

G. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

H. Furnish as-built/as-installed schedule with close-out documents, including keying schedule and transcript, wiring/riser diagrams, manufacturers' installation and adjustment and maintenance information.

I. Fire Door Assembly Testing: Submit a written record of each fire door assembly to the Owner to be made available to the Authority Having Jurisdiction (AHJ) for future building inspections.

J. LEED Certification Points: Submit information and certifications necessary to achieve maximum points for LEED certification; coordinate and cooperate with Owner and Architect in providing information necessary for required LEED rating.

1.5 QUALITY ASSURANCE

A. Obtain each type of hardware (latch and lock sets, hinges, closers, exit devices, etc.) from a single manufacturer.

B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this project and that employs an experienced architectural hardware consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.
   1. Responsible for detailing, scheduling and ordering of finish hardware.
   2. Meet with Owner to finalize keying requirements and to obtain final instructions in writing.
   3. Stock parts for products supplied and are capable of repairing and replacing hardware items found defective within warranty periods.

C. Hardware Installer: Company specializing in the installation of commercial door hardware with five years documented experience.

D. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and tested by UL or Warnock Hersey for given type/size opening and degree of label. Provide proper latching hardware, door closers, approved-bearing hinges and seals whether listed in the Hardware Schedule or not.
   1. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors' UL labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL label on exit devices indicating "Fire Exit Hardware".

E. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.

F. Product packaging to be labelled in compliance with CA Prop 65, Safe Drinking Water and Toxic Enforcement Act of 1986.

1.6 DELIVERY, STORAGE AND HANDLING

A. Coordinate delivery of packaged hardware items to the appropriate locations (shop or field) for installation.

B. Hardware items shall be individually packaged in manufacturers' original containers, complete with proper fasteners. Clearly mark packages on outside to indicate contents and locations in hardware schedule and in work.

C. Provide locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, etc.

D. Contractor to inventory door hardware jointly with representatives of hardware supplier and hardware installer until each all are satisfied that count is correct.

1.7 WARRANTY

A. Provide warranties of respective manufacturers' regular terms of sale from day of final acceptance as follows:
1. Locksets: Ten (10) years.
2. Exit devices: Three (3) years.
3. Closers: Thirty (30) years.
4. Electronic: One (1) year.
5. All other hardware: Two (2) years.

1.8 MAINTENANCE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

1.9 PRE-INSTALLATION CONFERENCE

A. Convene a pre-installation conference at least one week prior to beginning work of this section.

B. Attendance: Architect, Construction Manager, Contractor, Security Contractor, Hardware Supplier, Installer, Key Owner's Personnel, and Project Inspector.

C. Agenda: Review hardware schedule, products, installation procedures and coordination required with related work. Review Owner's keying standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

Item	Manufacturer	Acceptable Substitutes
Hinges	Ives	Hager, Stanley, McKinney
Locks, Latches & Cylinders	Schlage	None – District Standard
Exit Devices	Von Duprin	None – District Standard
Closers	LCN	None – District Standard
Push, Pulls & Protection Plates	Ives	Trimco, BBW, DCI
Flush Bolts	Ives	Trimco, BBW, DCI
Coordinators	Ives	Trimco, BBW, DCI
Door Stops	Ives	Trimco, BBW, DCI
Overhead Stops	Glynn-Johnson	Or Approved Equal

Thresholds	Zero	Pemko, National Guard
Seals & Bottoms	Zero	Pemko, National Guard

2.2 MATERIALS

A. Hinges:
1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Hinges shall be sized in accordance with the following:
   a. Height:
      1) Doors up to 42" wide: 4-1/2 inches.
      2) Doors 43" to 48" wide: 5 inches.
   b. Width: Sufficient to clear frame and trim when door swings 180 degrees.
   c. Number of Hinges: Provide 3 hinges per leaf to 7'-5" in height. Add one for each additional 2 feet in height.
3. Exterior out-swinging hinges shall be non-ferrous material and shall have stainless steel hinge pins. All doors to have non-rising pins.
4. Furnish non-removable pins (NRP) at all exterior out-swing doors and interior key lock doors with reverse bevels.
5. Provide hinges with electrified options as scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component.

B. Continuous Hinges:
1. Provide aluminum geared continuous hinges fabricated from 6063-T6 aluminum conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
3. Provide continuous hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
4. Provide continuous hinges 1” shorter in length than nominal height of door, unless otherwise noted, with symmetrical hole pattern.
5. On fire-rated doors, provide continuous hinges that are UL listed for use on fire-rated doors.
6. Install continuous hinges with fasteners supplied by manufacturer.

C. Heavy Duty Cylindrical Locks and Latches: Schlage "ND" Series as scheduled with "Rhodes" lever design.
1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3 hour fire doors.
2. Provide cylindrical locksets exceeding the ANSI/BHMA A156.2 Grade 1 performance standards for strength, security, and durability in the categories below:
   a. Abusive locked lever torque – minimum 3,100 inch-pounds without gaining access.
   b. Offset lever pull – minimum 1,600 foot pounds without gaining access.
   c. Vertical lever impact – minimum 100 impacts without gaining access.
   d. Cycle Test – tested to minimum 16 million cycles with no visible lever sag; without the use of performance aids such as set screws or spacers.
3. Cylinders: Refer to “KEYING” article, herein.
4. Provide locks with standard 2-3/4” backset, unless noted otherwise, with 1/2” latch throw. Provide proper latch throw for UL listing at pairs.
5. Provide locksets with separate solid steel anti-rotation thru-bolts, and no exposed screws.
6. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
7. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
8. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.

9. Provide levers with vandal resistant technology as scheduled for use at abusive applications.
10. Provide wired electrified options as scheduled in the hardware sets.
    a. 12 or 24 volt DC auto-detecting operating capability.
    b. Selectable EL (fail safe) or EU (fail secure) operating mode via switch on chassis.
    c. 0.23A (230mA) maximum current draw.
    d. 0.01A (10mA) holding current.
    e. Modular request to exit (RX) switch.

D. Deadbolts:
1. Provide deadbolts confirming to ANSI/BHMA A156.36 Grade 1, and UL Listed for 3 hour fire door with function as specified.
2. Deadbolts shall be mounted with three 3" screws that shall anchor metal dustbox to frame. 1/4” machine screws through bolt to firmly anchor lock to door and hardened steel ball bearings to protect bolts from drill attacks.
3. Cylinders: Refer to “KEYING” article, herein.
4. Provide deadbolts with standard 2-3/4” backset, unless noted otherwise, with full 1” throw, constructed of steel alloy.
5. Provide manufacturer’s standard strike.

E. Exit devices: Von Duprin as scheduled.
1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Provide certificate by independent testing laboratory that device has completed over 1,000,000 cycles and can still meet ANSI/BHMA A156.3 standards.
3. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Provide exit devices cut to door width and height. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
6. Provide flush end caps for exit devices.
7. Exit devices shall comply with CBC Section 11B-404.2.7 and shall be mounted between 34" and 44" above the finished floor surface.
8. Provide exit devices UL certified to meet 5 lbs. maximum unlatching force requirements according to the CBC Section 11B-309.4.
9. Cylinders: Refer to “KEYING” article, herein.
10. Provide cylinder dogging as specified at non fire-rated openings. Provide cylinder dogging indicators (CDSI) for visible indication of dogging status as specified.
11. Removable Mullions: Provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
12. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
13. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
14. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.
15. Provide exit devices with manufacturer’s approved strikes.
16. Provide electrified options as scheduled.
17. Panic hardware shall not be provided with “Night Latch” (NL) function for any accessible doors or gates unless the following conditions are met per DSA Interpretation 10-08 DSA/AC. Such conditions must be clearly demonstrated and indicated in the specification:
    a. Panic hardware contains a “dogging” feature and during the time the facility is open the panic hardware shall be “dogged”.

b. The act of “dogging” a door in the open position shall only be performed by employees as a part of their job function (non-public use).

F. Closers: LCN as scheduled.
1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Provide certificate by independent testing laboratory that door closers have completed over 10,000,000 cycles and can still meet ANSI/BHMA A156.4 standards.
4. Cylinder Body: 1-1/2” diameter with 3/4” diameter double heat-treated pinion journal.
5. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120° F to -30° F.
6. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
7. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
8. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
9. Pressure Relief Valve (PRV) Technology: Not permitted.
10. Provide door closers powder coated to match balance of door hardware. Powder coating finish shall be certified to exceed 100 hours salt spray testing as described in ANSI/BHMA A156.4 and ASTM B117.
11. Provide special rust inhibitor (SRI) in highly corrosive areas, and where noted in hardware sets.
12. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

G. Flush Bolts & Dust Proof Strikes:
1. Automatic flush bolts shall be of the low operating force design.
2. Provide top bolt only model for interior doors where applicable and as permitted by testing procedures.
3. Provide dust proof strikes at openings using bottom bolts.
4. Manual flush bolts shall only be permitted on storage or mechanical openings, as scheduled.

H. Door Stops:
1. Unless otherwise noted in hardware sets, provide wall type with appropriate fasteners. Where wall type cannot be used, provide floor type. If neither can be used, provide overhead type.
2. Do not install floor stops more than four (4) inches from the face of the wall or partition (CBC Section 11B-307).
3. Provide backing plate at wall framing behind wall type.
4. Overhead stops shall be made of stainless steel and non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions. Stop-only function shall be provided at fire-rated openings.

I. Protection Plates:
1. Provide kick, mop, and/or armor plates minimum of 0.050” thick, with four beveled edges. Furnish with sheet metal or wood screws, finished to match plates.
2. Kick plates shall be sized 10" high and 2" less door width (LDW) at single doors and 10” high and 1” LDW at pairs or doors.
3. Provide mop and armor plates with sizes as scheduled in hardware sets.

J. Thresholds: As scheduled and per details.
1. Thresholds shall not exceed 1/2" in height, with a beveled surface of 1:2 maximum slope. Thresholds shall comply with CBC Section 11B-404.2.5.
2. Set thresholds in a full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements in Division 07 “Thermal and Moisture Protection”.
3. Use 1/4” fasteners, red-head flat-head sleeve anchors (SS/FHSL).

K. Seals: Provide silicone gasket at all rated and exterior doors.
1. Smoke & Draft Control Doors: Provide UL10C Classified gasketing that complies with NFPA 80 & NFPA 252 for use on “S” labeled Positive Pressure door assemblies.

L. Silencers: Furnish silencers for interior hollow metal frames, 3 for single doors, 2 for pairs of doors. Omit where sound or light seals occurs, or for fire-resistive-rated door assemblies.

2.3 KEYING

A. Furnish a Proprietary Schlage Classic Primus masterkey system as directed by the District lock shop. Key system to be designated and combinated by the Schlage Master Key Department even if pinned by the Authorized Key Center, Authorized Security Center or a local authorized commercial dealer.

B. A detailed keying schedule is to be prepared by the District lock shop and/or architect in consultation with a representative of Allegion or an Authorized Key Center or Authorized Security Center. Each keyed cylinder on every keyed lock is to be listed separately showing the door #, key group (in BHMA terminology), cylinder type, finish and location on the door.

C. Furnish all cylinders in the Schlage conventional (KIL) style except the exit device and removable mullion cylinders which shall be supplied in Schlage Full Size Interchangeable Core (FSIC) style. Pack change keys independently (PKI). Verify keyway with Central Unified School District lock shop.

D. Furnish construction keying for doors requiring locking during construction.

E. Furnish all keys with visual key control.
1. Stamp key “Do Not Duplicate”.
2. Stamp (BHMA) key symbol on key.
3. Stamp unique owner identifier from the key bow.

F. Furnish all mechanical keys as Primus with quantities as follows:
1. Furnish 2 cut change keys for each different change key code.
2. Furnish 1 uncut key blank for each change key code.
3. Furnish 6 cut masterkeys for each different masterkey set.
4. Furnish 3 uncut key blanks for each masterkey set.
5. Furnish 2 cut control keys cut to the top masterkey for permanent I/C cylinders.
6. Furnish 1 cut control key cut to each SKD combination.
7. Furnish 50 uncut key blanks.

G. Furnish Schlage Padlocks and the cylinders to tie them into the masterkey system for gates, storage boxes, utility valve security, roof hatches and roll-up doors keyed as directed in the keying schedule.
1. Furnish KS43F2200 padlock for use with non-I/C Schlage cylinders. Furnish 47-413 (conventional core) or 47-743 (Primus core) with above.
2. Furnish KS43F3200 padlock for use with FSIC Schlage cylinders. Furnish 23-030 (FSIC core) or 20-740 (Primus core) with above.

H. Furnish one Schlage cabinet lock for each cabinet door or drawer so designated on the drawings or keying schedule to match the masterkey system.
   1. Furnish CL100PB for use with non-I/C Schlage cylinders.
   2. Furnish CL777R for use with FSIC Schlage cylinders.

2.4 FINISHES

A. Generally to be satin chrome US26D (626 on bronze and 652 on steel) unless otherwise noted.

B. Furnish push plates, pull plates and kick or armor plates in satin stainless steel US32D (630) unless otherwise noted.

C. Door closers shall be powder-coated to match other hardware, unless otherwise noted.

D. Aluminum items to be finished anodized aluminum except thresholds which can be furnished as standard mill finish.

2.5 FASTENERS

A. Screws for strikes, face plates and similar items shall be flat head, countersunk type, provide machine screws for metal and standard wood screws for wood.

B. Screws for butt hinges shall be flathead, countersunk, full-thread type.

C. Fastening of closer bases or closer shoes to doors shall be by means of sex bolts and spray painted to match closer finish.

D. Provide expansion anchors for attaching hardware items to concrete or masonry.

E. All exposed fasteners shall have a phillips head.

F. Finish of exposed screws to match surface finish of hardware or other adjacent work.

G. All Exit Devices and Lock Protectors shall be fastened to the door by the means of sex bolts or through bolts.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that doors and frames are square and plumb and ready to receive work and dimensions are as instructed by the manufacturer.

B. Beginning of installation means acceptance of existing conditions.

C. Fire-Rated Door Assembly Inspection: Upon completion of the installation, all fire door assemblies shall be inspected to confirm proper operation of the closing device and latching device and that only the manufacturer's furnished fasteners are used for installation and that it meets all criteria of a fire door assembly per NFPA 80 (Standard for Fire Doors and Other Opening Protectives) 2016 Edition. A written record shall be maintained and transmitted to the Owner to be made available to the Authority Having Jurisdiction (AHJ). The inspection of the swinging fire doors shall be performed by a certified FDAI (Fire Door Assembly Inspector) with knowledge and understanding of the operating components of the type of door being subjected to the inspection. The record shall list each fire door assembly throughout the project and

include each door number, an itemized list of hardware set components at each door opening, and each door location in the facility.

3.2 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and requirements of DHI.

B. Use the templates provided by hardware item manufacturer.

C. Mounting heights for hardware shall be as recommended by DHI. Operating hardware shall be located between 34" and 44" above finish floor to comply with CBC Section 11B-404.2.7.

D. Door Closers:
   1. Place door closers inside building, stairs, rooms, etc. Closers shall be installed to permit doors to swing 180 degrees or maximum allowable by conditions.
   2. Maximum effort to operate closers shall not exceed 5 lbs., such pull or push effort being applied at right angles to hinged doors.
   3. When fire doors are required, the maximum effort to operate the closer may be increased but shall not exceed 15 lbs. when specifically approved by fire marshal.
   4. All closers shall be adjusted to operate with the minimum amount of opening force and still close and latch the door. These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position.
   5. Compensating devices or automatic door operators may be utilized to meet the above standards.
   6. Per CBC Section 11B-404.2.8.1, doors shall take minimum of 5 seconds to move from an open position of 90 degrees to 12 degrees to the latch jamb.

E. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

F. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

G. Set thresholds for exterior doors in full bed of butyl-rubber sealant.

H. If hand of door is changed during construction, make necessary changes in hardware at no additional cost.

I. Electronic Hardware:
   1. Hardware Installer shall coordinate with security contractor to route cable to connect electrified locks, panic hardware and fire exit hardware to power transfers or electric hinges at the time these items are installed so as to avoid disassembly and reinstallation of hardware.
   2. Hardware Installer shall also be present with the security contractor when the power is turned on for the testing of the electronic hardware applications. Installer shall make adjustments to solenoids, latches, vertical rods and closers to insure proper and secure operation.
   3. All wiring for electro-mechanical hardware mounted on the door shall be connected through the power transfer and terminated in the interface junction box specified for in the Electrical Section.
   4. Conductors shall be minimum 18 gage stranded, multicolored. A minimum 12 in. loop of conductors shall be coiled in the interface junction box. Each conductor shall be permanently marked with its function.
   5. If a power supply is specified in the hardware sets, all conductors shall be terminated in the power supply. Make all connections required for proper operation between the power

supply and the electro-mechanical hardware. Provide the proper size conductors as specified in the manufacturer's technical documentation.

3.3 ADJUST AND CLEAN

A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

B. Clean adjacent surface soiled by hardware installation.

C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy, return to that work area and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware finishes, during the final adjustment of hardware.

E. Continued Maintenance Service: Approximately six months after the completion of the project, the Contractor accompanied by the Architectural Hardware Consultant, shall return to the project and re-adjust every item of hardware to restore proper functions of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.4 HARDWARE LOCATIONS

A. Conform to CCR, Title 24, Part 2; and ADAAG; and the drawings for access-compliant positioning requirements for the disabled.

3.5 FIELD QUALITY CONTROL

A. Contractor is responsible for providing the services of an Architectural Hardware Consultant (AHC) or a proprietary product technician to inspect installation and certify that hardware and its installation have been furnished and installed in accordance with manufacturers' instructions and as specified herein.

3.6 HARDWARE SCHEDULE

A. The items listed in the following schedule shall conform to the requirements of the foregoing specifications.

B. While the hardware schedule is intended to cover all doors, and other movable parts of the building, and establish type and standard of quality, the contractor is responsible for examining the Plans and Specifications and furnishing proper hardware for all openings whether listed or not. If there are any omissions in hardware groups in regard to regular doors they shall be called to the attention of the Architect prior to bid opening for instruction; otherwise, list will be considered Complete. No extras will be allowed for omissions.

C. The Door Schedule on the Drawings indicates which hardware set is used with each door.

MANUFACTURERS ABBREVIATIONS

GLY	=	Glynn-Johnson	Overhead Door Stops
IVE	=	Ives	Hinges, Push/Pull Plates, Flush Bolts, Coordinators, Door Stops, Kick Plates & Silencers
LCN	=	LCN	Door Closers
SCH	=	Schlage Lock	Locks, Latches & Cylinders
VON	=	Von Duprin	Exit Devices
ZER	=	Zero International	Thresholds, Gasketing & Weather-stripping

HW GROUP NO. 01

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	CONT. HINGE	224XY EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	REMOVABLE MULLION	KR4954 X 154	689	VON
1	EA	PANIC HARDWARE	LD-PA-AX-98-EO	626	VON
1	EA	ELEC PANIC HARDWARE	QELX-PA-AX-98-NL	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX	626	SCH
2	EA	PRIMUS CORE	20-740	626	SCH
2	EA	SURFACE CLOSER	4111 EDA TBSRT	689	LCN
2	EA	FLOOR STOP/HOLDER	FS43	626	IVE
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
1	SET	WEATHERSTRIP	SEALS BY DOOR/FRAME MFR		
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC		VON
		CARD READER	BY WORK OF DIVISION 28		

HW GROUP NO. 02

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	CONT. HINGE	224XY EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	REMOVABLE MULLION	KR4954 X 154	689	VON
1	EA	PANIC HARDWARE	LD-PA-AX-98-EO	626	VON
1	EA	ELEC PANIC HARDWARE	QELX-PA-AX-98-NL	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX	626	SCH
2	EA	PRIMUS CORE	20-740	626	SCH
2	EA	OH STOP & HOLDER	100H ADJ	630	GLY
2	EA	SURFACE CLOSER	4111 EDA TBSRT	689	LCN
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
1	SET	WEATHERSTRIP	SEALS BY DOOR/FRAME MFR		
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC		VON
		CARD READER	BY WORK OF DIVISION 28		

HW GROUP NO. 03

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	CONT. HINGE	224XY EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	REMOVABLE MULLION	KR4954 X 154	689	VON
1	EA	PANIC HARDWARE	LD-PA-AX-98-EO	626	VON
1	EA	ELEC PANIC HARDWARE	QELX-PA-AX-98-NL	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX	626	SCH
2	EA	PRIMUS CORE	20-740	626	SCH
2	EA	SURFACE CLOSER	4111 EDA TBSRT	689	LCN
2	EA	FLOOR STOP/HOLDER	FS43	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	SET	MEETING STILE	328AA-S	AA	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC		VON
		CARD READER	BY WORK OF DIVISION 28		

HW GROUP NO. 04

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	224XY	628	IVE
1	EA	REMOVABLE MULLION	KR4954 X 154	689	VON
1	EA	PANIC HARDWARE	CDSI-PA-AX-98-NL	626	VON
1	EA	PANIC HARDWARE	LD-PA-AX-98-EO	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX XQ11-948	626	SCH
3	EA	PRIMUS CORE	20-740	626	SCH
2	EA	SURFACE CLOSER	4111 EDA TBSRT	689	LCN
2	EA	FLOOR STOP/HOLDER	FS43	626	IVE
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
1	SET	WEATHERSTRIP	SEALS BY DOOR/FRAME MFR		
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO. 05

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	224XY	628	IVE
1	EA	REMOVABLE MULLION	KR4954 X 154	689	VON
1	EA	PANIC HARDWARE	CDSI-PA-AX-98-NL	626	VON
1	EA	PANIC HARDWARE	LD-PA-AX-98-EO	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX XQ11-948	626	SCH
3	EA	PRIMUS CORE	20-740	626	SCH
2	EA	SURFACE CLOSER	4111 EDA TBSRT	689	LCN
2	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	SET	MEETING STILE	328AA-S	AA	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO. 06

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	QELX-PA-AX-98-NL	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4111 EDA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP/HOLDER	FS43	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC		VON
		CARD READER	BY WORK OF DIVISION 28		

HW GROUP NO. 07

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	PANIC HARDWARE	CDSI-PA-AX-98-NL	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX XQ11-948	626	SCH
2	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4111 EDA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO. 08

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	VANDL CLASSROOM SEC	ND95PD RHO XN12-035	626	SCH
1	EA	PRIMUS K-I-L CYL.	20-765	626	SCH
1	EA	PERMANENT CYLINDER	23-065	626	SCH
1	EA	SURFACE CLOSER	4111 EDA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO. 09

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	VANDL CLASSROOM SEC	ND95PD RHO XN12-035	626	SCH
1	EA	PRIMUS K-I-L CYL.	20-765	626	SCH
1	EA	PERMANENT CYLINDER	23-065	626	SCH
1	EA	SURFACE CLOSER	4111 SCUSH TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO. 10

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	VANDL CLASSROOM LOCK	ND94PD RHO	626	SCH
1	EA	PRIMUS K-I-L CYL.	20-765	626	SCH
1	EA	SURFACE CLOSER	4111 EDA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP/HOLDER	FS43	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO. 11

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	VANDL CLASSROOM LOCK	ND94PD RHO	626	SCH
1	EA	PRIMUS K-I-L CYL.	20-765	626	SCH
1	EA	OH STOP & HOLDER	100H ADJ	630	GLY
1	EA	SURFACE CLOSER	4111 EDA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO. 12

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	DUTCH DOOR BOLT	054	626	IVE
1	EA	VANDL STOREROOM LOCK	ND96PD RHO	626	SCH
1	EA	PRIMUS K-I-L CYL.	20-765	626	SCH
1	EA	SURFACE CLOSER	4111 EDA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP/HOLDER	FS43	626	IVE
1	EA	WALL STOP/HOLDER	WS45	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO. 13

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	PA-AX-98-NL	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4111 SCUSH TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO. 14

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	VANDL STOREROOM LOCK	ND96PD RHO	626	SCH
1	EA	PRIMUS K-I-L CYL.	20-765	626	SCH
1	EA	SURFACE CLOSER	4111 EDA TBSRT	689	LCN
1	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO. 15

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	CONST LATCHING BOLT	FB51P	630	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2	626	IVE
1	EA	VANDL STOREROOM LOCK	ND96PD RHO	626	SCH
1	EA	PRIMUS K-I-L CYL.	20-765	626	SCH
1	EA	SURFACE CLOSER	4111 EDA TBSRT (ON ACTIVE LEAF ONLY)	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	FLOOR STOP/HOLDER	FS43	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	ASTRAGAL	44STST OR BY HM DOOR MFR	STST	ZER
1	EA	THRESHOLD	PER DETAIL	A	ZER

HW GROUP NO. 16

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	FIRE RATED REMOVABLE MULLION	KR9954 X 154	689	VON
1	EA	FIRE EXIT HARDWARE	PA-AX-98-EO-F	626	VON
1	EA	FIRE EXIT HARDWARE	PA-AX-98-L-F-2SI-06	626	VON
2	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX	626	SCH
3	EA	PRIMUS CORE	20-740	626	SCH
2	EA	SURFACE CLOSER	4111 EDA TBSRT	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
2	EA	FLOOR STOP	FS436	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	SET	MEETING STILE	328AA-S	AA	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER

HW GROUP NO. 17

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM SECURITY	ND75PD RHO XN12-035	626	SCH
1	EA	PRIMUS K-I-L CYL.	20-765	626	SCH
1	EA	PERMANENT CYLINDER	23-065	626	SCH
1	EA	SURFACE CLOSER	4111 EDA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO. 18

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY	ND75PD RHO XN12-035	626	SCH
1	EA	PRIMUS K-I-L CYL.	20-765	626	SCH
1	EA	PERMANENT CYLINDER	23-065	626	SCH
1	EA	SURFACE CLOSER	4011 H TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO. 19

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70PD RHO	626	SCH
1	EA	PERMANENT CYLINDER	23-065	626	SCH
1	EA	SURFACE CLOSER	4111 EDA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO. 20

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70PD RHO	626	SCH
1	EA	PERMANENT CYLINDER	23-065	626	SCH
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4011 TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO. 21

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PUSH PLATE	8200 6" X 16"	630	IVE
1	EA	PULL PLATE	8302 10" 4" X 16" F	630	IVE
1	EA	SURFACE CLOSER	4011 TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW GROUP NO. 22

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	ND40S RHO	626	SCH
1	EA	SURFACE CLOSER	4011 TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO. 23

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50PD RHO	626	SCH
1	EA	PRIMUS K-I-L CYL.	20-765	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO. 24

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50PD RHO	626	SCH
1	EA	PERMANENT CYLINDER	23-065	626	SCH
1	EA	OH STOP & HOLDER	100H	630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW GROUP NO. 25

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	DBL CYL STORE LOCK	ND66PD RHO	626	SCH
2	EA	PERMANENT CYLINDER	23-065	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO. 26

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80PD RHO	626	SCH
1	EA	PERMANENT CYLINDER	23-065	626	SCH
1	EA	SURFACE CLOSER	4011 OR 4111 EDA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO. 27

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80PD RHO	626	SCH
1	EA	PERMANENT CYLINDER	23-065	626	SCH
1	EA	SURFACE CLOSER	4011 H TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW GROUP NO. 28

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ADA STOREROOM LOCK	ND81PD RHO	626	SCH
1	EA	PERMANENT CYLINDER	23-065	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW GROUP NO. 29

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	SPRING HINGE	3SP1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50PD RHO	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE

HW GROUP NO. 30

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CONST LATCHING BOLT	FB62	630	IVE
1	EA	ADA STOREROOM LOCK	ND81PD RHO	626	SCH
1	EA	PERMANENT CYLINDER	23-065	626	SCH
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	SURFACE CLOSER	4011 TBSRT	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	FLOOR STOP	FS436	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	ASTRAGAL	44STST	STST	ZER

HW GROUP NO. 31

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	MANUAL FLUSH BOLT	FB358	626	IVE
1	EA	ADA STOREROOM LOCK	ND81PD RHO	626	SCH
1	EA	PERMANENT CYLINDER	23-065	626	SCH
1	EA	OH STOP	90S	630	GLY
1	EA	WALL STOP	WS406/407CCV	630	IVE
2	EA	SILENCER	SR64	GRY	IVE

HW GROUP NO. 32

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
2	EA	ROLLER LATCH	RL30	626	IVE
1	EA	CLASSROOM DEADBOLT	B663P6	626	SCH
2	EA	FLUSH PULL	7060	626	TRI

HW GROUP NO. 33 - HARDWARE BY ROLL-UP DOOR MANUFACTURER

END OF SECTION 08 71 00

LEVEL	DOOR NO.	HWSET#
1ST FLOOR	101	01
1ST FLOOR	102	04
1ST FLOOR	103	04
1ST FLOOR	104	01
1ST FLOOR	105	15
1ST FLOOR	106	06
1ST FLOOR	107	10
1ST FLOOR	108	10
1ST FLOOR	109	06
1ST FLOOR	110	01
1ST FLOOR	111	13
1ST FLOOR	112	08
1ST FLOOR	113	08
1ST FLOOR	114	09
1ST FLOOR	115	02
1ST FLOOR	116	11
1ST FLOOR	117	10
1ST FLOOR	118	01
1ST FLOOR	119	17
1ST FLOOR	120	20
1ST FLOOR	121	26
1ST FLOOR	122	17
1ST FLOOR	123	24
1ST FLOOR	124	19
1ST FLOOR	125	19
1ST FLOOR	126	24
1ST FLOOR	127	17
1ST FLOOR	128	26
1ST FLOOR	129	17
1ST FLOOR	130	24
1ST FLOOR	131	19
1ST FLOOR	132	19
1ST FLOOR	133	24
1ST FLOOR	134	17
1ST FLOOR	135	26
1ST FLOOR	136	23
1ST FLOOR	137	12
1ST FLOOR	138	23
1ST FLOOR	139	16
1ST FLOOR	140	28
1ST FLOOR	141	23
1ST FLOOR	142	23
1ST FLOOR	143	23
1ST FLOOR	144	23
1ST FLOOR	145	23
1ST FLOOR	146	23
1ST FLOOR	147	23

LEVEL	DOOR NO.	HWSET#
1ST FLOOR	148	17
1ST FLOOR	149	23
1ST FLOOR	150	19
1ST FLOOR	151	22
1ST FLOOR	152	19
1ST FLOOR	153	19
1ST FLOOR	154	17
1ST FLOOR	155	25
1ST FLOOR	156	17
1ST FLOOR	157	17
1ST FLOOR	158	25
1ST FLOOR	159	17
1ST FLOOR	160	26
1ST FLOOR	161	17
1ST FLOOR	162	17
1ST FLOOR	163	25
1ST FLOOR	164	17
1ST FLOOR	165	17
1ST FLOOR	166	08
1ST FLOOR	167	17
1ST FLOOR	168	17
1ST FLOOR	170	17
1ST FLOOR	171	29

LEVEL	DOOR NO.	HWSET#
2ND FLOOR	201	17
2ND FLOOR	202	17
2ND FLOOR	203	17
2ND FLOOR	204	25
2ND FLOOR	205	17
2ND FLOOR	206	26
2ND FLOOR	207	17
2ND FLOOR	208	25
2ND FLOOR	209	17
2ND FLOOR	210	17
2ND FLOOR	211	17
2ND FLOOR	212	25
2ND FLOOR	213	17
2ND FLOOR	214	25
2ND FLOOR	215	17
2ND FLOOR	216	17
2ND FLOOR	217	31
2ND FLOOR	218	26
2ND FLOOR	219	21
2ND FLOOR	220	21
2ND FLOOR	221	19
2ND FLOOR	222	19
2ND FLOOR	223	17
2ND FLOOR	224	25
2ND FLOOR	225	17
2ND FLOOR	226	17
2ND FLOOR	227	25
2ND FLOOR	228	17
2ND FLOOR	229	17
2ND FLOOR	230	17
2ND FLOOR	231	25
2ND FLOOR	232	17
2ND FLOOR	233	17
2ND FLOOR	234	17

LEVEL	DOOR NO.	HWSET#
MULTI-PURPOSE	301	04
MULTI-PURPOSE	302	01
MULTI-PURPOSE	303	04
MULTI-PURPOSE	304	05
MULTI-PURPOSE	305	08
MULTI-PURPOSE	306	14
MULTI-PURPOSE	307	07
MULTI-PURPOSE	308	07
MULTI-PURPOSE	309	14
MULTI-PURPOSE	311	03
MULTI-PURPOSE	312	01
MULTI-PURPOSE	313	04
MULTI-PURPOSE	314	17
MULTI-PURPOSE	315	17
MULTI-PURPOSE	316	14
MULTI-PURPOSE	317	22
MULTI-PURPOSE	318	27
MULTI-PURPOSE	319	BY MFR
MULTI-PURPOSE	320	BY MFR
MULTI-PURPOSE	321	28
MULTI-PURPOSE	322	33
MULTI-PURPOSE	323	18
MULTI-PURPOSE	324	23
MULTI-PURPOSE	325	30
MULTI-PURPOSE	326	17
MULTI-PURPOSE	328	21
MULTI-PURPOSE	329	21
MULTI-PURPOSE	330	17
MULTI-PURPOSE	331	32
MULTI-PURPOSE	332	32
MULTI-PURPOSE	333	32
MULTI-PURPOSE	334	32
MULTI-PURPOSE	335	32
MULTI-PURPOSE	336	33

SECTION 21 00 00 - FIRE SUPPRESSION SPRINKLER SYSTEMS

AD 5-09a
S&B Elemenatary
02-116800

PART 1 GENERAL

5

1.1 SECTION INCLUDES

A. Wet-Pipe Fire Sprinkler System.

B. System Design, Installation and Certification.

1.2 RELATED REQUIREMENTS

A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 01 - General Requirements apply to this section.

B. Section 28 46 00 – Fire Detection and Alarm.

C. Section 21 00 01 - Common Work Results for Fire Suppression: Pipe, fittings, and valves.

D. Section 21 00 02 - Identification for Fire Suppression Piping and Equipment: Piping Identification.

E. Divisions 22/ 23 – Plumbing/ Mechanical.

F. Division 26 – Electrical.

G. Division 27/ 28 – Technology/ Fire Alarm.

1.3 REFERENCE STANDARDS

A. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.

B. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association 2016.

C. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories, Inc.; current edition.

D. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

E. ASTM B75 - Seamless Copper Tube.

F. ASTM B88 - Seamless Copper Water Tube.

G. ASTM B251 - General Requirements for Wrought Seamless Copper and Copper Alloy Tube.

H. AWS D10.9 - Specifications for Qualification of Welding Procedures and Welders for Piping and Tubing.

1.4 SUBMITTALS

A. See Division 01 for Administrative Requirements, for Submittal Procedures.

B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Shop Drawings: Fire sprinkler system design is not a deferred submittal. The overall system design is approved by DSA. The overall system design is a directive for the installation of the system.
   1. Examine Contract Documents prior to bidding of Work and report discrepancies in writing to LEAF Engineers.
   2. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The fire protection Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.
   3. Architectural and structural Drawings are part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over fire protection Drawings.
   4. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in locations shown. Obtain LEAF Engineers' approval prior to relocation of equipment and materials.
   5. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
   6. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, seismic details and calculations, components, and accessories. Indicate system controls.
   7. Submit shop drawings to LEAF Engineers for approval prior to fabrication or installation.
   8. Installation is to conform to the DSA approved fire sprinkler plans.
   9. Approved documents do not relieve the contractor of field coordination. It is the fire sprinkler contractors' responsibility to coordinate piping locations with the work of other trades.
   10. Preparation of installation and fabrication drawings is the responsibility of the fire sprinkler contractor.

D. Material Data: DSA Approved material data is a guideline. The fire sprinkler system design parameters must be strictly adhered to. Alternate manufacturers may be submitted to LEAF Engineers for review of project compliance. DSA approval must be obtained prior to installation. A copy of the approved material data must be on the project site for the Project Inspector prior to the commencement of installation.

E. Substitutions:
   1. It is the responsibility of Contractor to assume costs incurred because of additional work and or changes required to incorporate proposed substitute into the Project.
   2. Substitutions will be interpreted to be manufacturers other than those specifically listed in Contract Documents by brand name, model, or catalog number.
   3. Only one request for substitution will be considered for each item of equipment or material.
   4. Substitution requests shall include the following:
      a. Reason for substitution request.
      b. Complete submittal information.

F. Project Record Documents: Record actual locations of sprinklers and deviations of piping

from drawings. Indicate drain and test locations.

G. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.

H. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

I. Maintenance Materials: Furnish the following for the Districts use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Extra Sprinklers: Type and size matching those installed, in quantity required by referenced NFPA design and installation standard.
3. Sprinkler Wrenches: For each sprinkler type.

1.5 QUALITY ASSURANCE

A. Maintain one copy of referenced design and installation standard on site.

B. Conform to UL and FM requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

D. Fabrication shop must provide welding certifications and copy of weld stamp. Weld stamp to be provided on all pipe at welds.

E. Installer Qualifications: Company specializing in performing the work of this section with minimum five years’ experience. Installing company must have a valid State of California contractors' license with a C-16 classification.

F. Equipment and Components: Provide products that bear UL and FM label or marking.

G. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc., as suitable for the purpose specified and indicated.

1.6 STRUCTURAL DESIGN REQUIREMENTS AND SEISMIC RESTRAINTS

A. Fire protection systems and equipment shall be anchored and seismically braced in accordance with all applicable codes and industry standards.

B. Contractor shall design seismic bracing for all fire protection equipment and systems to comply with the 2022 California Building Code (CBC) and the latest edition of the Mason Industries "Seismic Restraint Guidelines".
1. Contractor shall submit details and calculations prepared and signed by a licensed professional structural engineer registered in the state in which the Work is performed demonstrating compliance with the above and all applicable codes.
2. Drawings, details, and calculations shall be submitted to the Architect for review. Compliance documents shall be approved by the Architect prior to installation.

C. Fire protection systems and equipment shall include, but are not limited to, all piping, valve assemblies, fire pumps, electrical and control panels, conduits, and other components.

D. Supports, anchorage and restraints, including attachments to building structure, for all piping for standard installation details that comply details shown on the fire sprinkler plans and

structural plans.

1.7 DELIVERY, STORAGE AND HANDLING

A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 PRODUCTS - ALL PRODUCTS SHALL CONFORM TO CONTRACT DOCUMENTS INCLUDING APPROVED MATERIAL DATA.

2.1 SPRINKLER SYSTEM

A. Sprinkler System: Provide coverage for building areas noted on Drawings, including all areas, rooms, spaces above and below ceilings, entry ways, overhangs (if applicable), etc. and all other areas requiring sprinklers in accordance with NFPA 13.

B. Occupancy: Administration: Light Hazard, Stage: Ordinary Hazard, Group 2, Library: Light Hazard, Classroom: Light Hazard, Lab Spaces: Ordinary Hazard, Group 2, Concession: Ordinary Hazard, Group 1, Concession/Restroom: Light Hazard, Locker Room: Light Hazard, Gymnasium: Light Hazard. Comply with NFPA 13, 2016. All storage rooms to have sprinklers spaced for ordinary hazard.

C. Interface system with building fire and smoke alarm system.

D. Provide fire department connections where indicated.

E. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to fire sprinkler riser. Supply no less than two (2) spare sprinklers of each type and temperature rating used on project. Storage cabinet to include a wrench(s) applicable to sprinkler types.

2.2 SPRINKLERS

A. Exposed Area Type: Upright.
1. Response Type: Quick.
2. Coverage Type: Standard.
3. Finish: Brass.
4. Fusible Link: Glass bulb type temperature rated for specific area hazard.
5. Application: Areas with exposed construction and all spaces above ceiling.

B. Finished Gypsum Board Ceilings and Suspended Ceilings: Semi-Recessed Pendent.
1. Response Type: Quick.
2. Coverage Type: Standard.
3. Finish: Chrome sprinkler with White escutcheon.
4. Fusible Link: Glass bulb type temperature rated for specific area hazard.

2.3 PIPING SPECIALTIES

A. Zone Control Valves:
1. Outside screw and yoke or butterfly, U.L. listed.
2. Valves shall be sealed open using approved seal.
3. Provide weatherproof actuator housing with two single pole double throw switches.

B. Electric Alarm: Electrically operated chrome plated gong with pressure alarm switch.

C. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.

D. Fire Department Connections:
1. Type: Free Standing with brass finish.
2. Outlets: Two way with thread size to suit fire department hardware; threaded dust cap and chain of matching material and finish.
3. Drain: 3/4 inch automatic drip, outside.
4. Label: "Sprinkler - Fire Department Connection".

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standards, DSA requirements and DSA approved plans.

B. Approved documents do not relieve the fire sprinkler contractor of field coordination. It is the fire sprinkler contractors' responsibility to coordinate piping locations with the work of other disciplines.

C. Strict adherence to the contract design documents is required. Any deviation from the contract documents requiring additional plan review, hydraulic calculations, structural review or calculations, or seismic calculations, shall be submitted to LEAF Engineers for review prior to making changes.

D. Install equipment in accordance with manufacturer's instructions.

E. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.

F. Preparation of installation and fabrication drawings is the responsibility of the fire sprinkler contractor.

G. Locate outside alarm gong on building wall as indicated on Fire Sprinkler Shop Drawings.

H. Place pipe runs to minimize obstruction to other work.

I. Place piping in concealed spaces above finished ceilings.

J. Center sprinklers in two directions in ceiling tile and provide piping offsets as required. Flex drops are not permitted.

K. All pendent or horizontal sidewall sprinklers are to be installed on return bends

L. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.

M. Flush entire piping system of foreign matter.

N. Install guards on sprinklers where subject to damage as in attic space where mechanical equipment is located and in mechanical room.

O. Hydrostatically test entire system.

P. Required test to be witnessed by IOR.

Q. Verification of weld inspection required prior to installation of fire sprinkler system.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Ensure required devices are installed and connected as required to fire alarm system.

END OF SECTION 21 00 00

SECTION 21 00 01 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

AD 5-09a
S&B Elemenatary
02-116800

PART 1 GENERAL

5

1.1 SECTION INCLUDES

A. Pipe, fittings, valves, and connections for sprinkler systems.

1.2 RELATED REQUIREMENTS

A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 01 - General Requirements apply to this section.

B. Section 21 00 00 – Fire Suppression Sprinkler Systems: Sprinkler systems design.

C. Section 21 00 02 - Identification for Fire Suppression Piping and Equipment: Piping Identification.

D. Divisions 22/ 23 – Plumbing/ Mechanical.

E. Division 26 – Electrical.

F. Division 27/ 28 – Technology/ Fire Alarm.

1.3 REFERENCE STANDARDS

A. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers.

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; The American Society of Mechanical Engineers.

C. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers.

D. ASME B16.4 - Gray Iron Threaded Fittings; The American Society of Mechanical Engineers.

E. ASME B16.9 - Factory-made Wrought Steel Buttwelding Fittings; The American Society of Mechanical Engineers.

F. ASTM A 47/ A 47M - Standard Specification for Ferritic Malleable Iron Castings.

G. ASTM A 53/ A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

H. ASTM A 795/ A 795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.

I. AWWA C110/ A21.10 - American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm Through 1200 mm), for Water and Other Liquids; American Water Works Association.

J. AWWA C111/ A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association (ANSI/ AWWA C111/ A21.11).

K. AWWA C151/ A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association (ANSI/ AWWA C151/ A21.51).

L. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2016.

M. NFPA 14 - Standpipe and Hose Systems.

N. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories, Inc.; current edition.

O. UL 262 - Gate Valves for Fire-Protection Service; Underwriters Laboratories, Inc.; Current Edition, Including All Revisions.

P. UL 312 - Check Valves for Fire-Protection Service; Underwriters Laboratories, Inc.; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 33 00 - Submittal Procedures.

B. Product Data: Provide manufacturers catalogue information. Indicate valve data and ratings.

C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, seismic restraints and calculations, and piping connections.
1. Examine Contract Documents prior to bidding of Work and report discrepancies in writing to Architect.
2. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The fire protection Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.
3. Architectural and structural Drawings are part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over fire protection Drawings.
4. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in locations shown. Obtain Architects' approval prior to relocation of equipment and materials.
5. Relocate equipment and materials installed without prior approval of Architect. Remove and relocate equipment and materials at Contactors' expense upon Architects' direction.
6. Minor changes in locations of equipment, piping, ducts, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner providing such change is ordered before such items of work or work directly connected to same are installed and providing no additional material is required.

D. Project Record Documents: Record actual locations of components and tag numbering.

E. Operation and Maintenance Data: Include installation instructions and spare parts lists.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Fabrication shop must provide welding certifications and copy of weld stamp. Weld stamp to be provided on all pipe at welds.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years' experience.

D. Conform to UL and FM requirements.

E. Valves: Bear UL and FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.

F. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

PART 2 PRODUCTS

2.1 FIRE PROTECTION SYSTEMS

A. Sprinkler Systems: Conform work to NFPA 13 and DSA requirements.

B. Welding Materials and Procedures: Conform to ASME Code.

2.2 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A 795 Schedule 10 or ASTM A 53 Schedule 40, black, or as approved by DSA:
   1. Steel Fittings: ASME B16.9, wrought steel, buttwelded.
      a. Schedule 10 Pipe: Shall be U.L. approved with U.L. approved grooved fittings and couplings for pipe sizes 2-1/2" and larger only. Schedule 10 pipe shall not be used for pipe sizes less than 2-1/2". Threaded fittings shall not be used for any Schedule 10 pipe.
   2. Cast Iron Fittings: ASME B16.1, flanges, and flanged fittings and ASME B16.4, threaded fittings.
   3. Malleable Iron Fittings: ASME B16.3, threaded fittings, and ASTM A 47/ A 47M.
   4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
   5. Mechanical formed fittings, including, but not limited to, tees, saddle fittings, bushings and mechanical sprinkler head fittings shall not be used.

B. Cast Iron Pipe: AWWA C151/ A21.51.
   1. Fittings: AWWA C110/ A21.10, standard thickness.
   2. Joints: AWWA C111, rubber gasket.

3. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped composition sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.

2.3 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.

B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, split ring.

C. Vertical Support: Steel riser clamp.

D. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.4 GATE VALVES

A. Up to and including 2 inches:
1. Bronze body, bronze trim, rising stem, handwheel, solid wedge or disc, threaded ends.

B. Over 2 inches:
1. Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, handwheel, OS&Y, solid bronze or cast iron wedge, flanged ends.

C. Over 4 inches:
1. Iron body, bronze trim, non-rising stem with bolted bonnet, solid bronze wedge, flanged ends, iron body indicator post assembly.

2.5 GLOBE OR ANGLE VALVES

A. Up to and including 2 inches:
1. Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable rubber disc, threaded ends, with backseating capacity repackable under pressure.

B. Over 2 inches:
1. Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat, and disc.

2.6 BALL VALVES

A. Up to and including 2 inches:
1. Bronze two piece body, brass, chrome plated bronze, or stainless steel ball, teflon seats and stuffing box ring, lever handle and balancing stops, threaded ends with union.

2.7 BUTTERFLY VALVES

A. Cast or Ductile Iron Body:
1. Cast or ductile iron, chrome or nickel plated ductile iron or aluminum bronze disc, resilient replaceable EPDM seat, wafer, lug, or grooved ends, extended neck, handwheel and gear drive and integral indicating device, and internal tamper switch rated 10 amp at 115 volt AC.

2.8 CHECK VALVES

A. Up to and including 2 inches:
   1. Bronze body and swing disc, rubber seat, threaded ends.

B. Over 2 inches and less than 4 inches:
   1. Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, flanged ends with automatic ball check.

C. 4 inches and Over:
   1. Iron body, bronze disc, stainless steel spring, resilient seal, threaded, wafer, or flanged ends.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.

B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

C. Install piping to conserve building space, to not interfere with use of space and other work.

D. Group piping whenever practical at common elevations.

E. Sleeve pipes passing through partitions, walls, and floors.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Pipe Hangers and Supports:
   1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   2. Place hangers within 12 inches of each horizontal elbow.
   3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.

H. Slope piping and arrange systems to drain at low points.

I. Prepare pipe, fittings, supports, and accessories for finish painting.

J. Do not penetrate building structural members unless indicated.

K. Provide sleeves when penetrating footings, floors, and walls. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.

L. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

M. Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.

N. Provide gate valves for shut-off or isolating service.

O. Provide drain valves at main shut-off valves, low points of piping and apparatus.

END OF SECTION 21 00 01

SECTION 21 00 02 - IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

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1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe Markers.

1.2 RELATED REQUIREMENTS

A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 01 General Requirements apply to this section.

B. Section 09 90 00 – Painting and Coating.

1.3 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers.

1.4 SUBMITTALS

A. See Section 01 33 00 – Submittals Procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

E. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Brady Corporation: www.bradycorp.com.

B. Champion America, Inc.: www.Champion-America.com.

C. Seton Identification Products: www.seton.com/aec.

2.2 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: Equipment, control panels, 1 inch.
   3. Letter Height: Controls and small components, 1/4 inch.

4. Background Color: Black.

2.3 TAGS

A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

2.4 PIPE MARKERS

A. Color: Conform to ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Secure to pipe using two (2) bands of adhesive tape with flow arrows supplied by the manufacturer. Install securing bands completely around pipe and overlapped.

D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

F. Identify valves in main and branch piping with tags.

G. Identify piping, concealed or exposed, with plastic pipe markers or plastic tape pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION 21 00 02

SECTION 22 00 00 - GENERAL PLUMBING PROVISIONS

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PART 1 GENERAL

1.1 GENERAL CONDITIONS

A. The foregoing General and Special Conditions shall form a part of this Division with the same force and effect as though repeated herein. The provisions of this Section shall apply to all the Sections of Division 22.

1.2 CODES AND REGULATIONS

A. All work and materials shall be in full accordance with current rules and regulations of applicable codes and all California Amendments. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes. Should the drawings or specifications call for material or methods of construction of a higher quality or standard than required by these codes, the specifications shall govern. Applicable codes and regulations are:

1. California Code of Regulations – CCR:
   a. Title 8, Industrial Relations.
   b. Title 24, Building Standards.
2. California Building Code – CBC.
3. California Mechanical Code – CMC.
4. California Plumbing Code – CPC.
5. California Fire Code – CFC.
6. California Green Building Code.
7. American Gas Association – AGA.
8. American National Standards Institute – ANSI.
9. American Society of Heating, Refrigerating and Air Conditioning Engineers – ASHRAE.
10. American Society of Mechanical Engineers – ASME.
11. American Society for Testing and Materials – ASTM.
12. American Water Works Association – AWWA.
13. Cast Iron Soil Pipe Institute – CISPI.
14. California Electrical Code – CEC.
15. National Electrical Manufacturers Association – NEMA.
16. National Fire Protection Association – NFPA.
17. National Sanitation Foundation – NSF.
18. Plumbing and Drainage Institute – PDI.
19. Sheet Metal and Air Conditioning Contractors National Association – SMACNA.
20. Underwriters' Laboratory – UL.
21. Occupational Safety and Health Act - OSHA.
22. California Assembly Bill 1953 (AB1953).

1.3 PERMITS AND FEES

A. The Contractor shall take out all permits and arrange for all tests in connection with his work as required by local ordinances. All charges are to be included in the work. Permits for equipment connected to a particular system are to be considered as a part of the work included under each system; for example, permits for electric motor connection are part of electrical work, permits for domestic water or gas connections are part of plumbing work. All charges for service connections, meters, etc. by utility companies or districts shall be included in the work.

1.4 COORDINATION OF WORK

A. Layout of materials, equipment and systems is generally diagrammatic unless specifically dimensioned. The actual locations of all materials, piping, fixtures, equipment, supports, etc. shall be carefully planned, prior to installation of any work, to avoid all interferences with each other, or with structural, electrical, or architectural elements. Verify the proper voltage and phase of all equipment with the electrical plans. All conflicts shall be called to the attention of the Engineer prior to the installation of any work or the ordering of any equipment.

1.5 GUARANTEE

A. Guarantee shall be in accordance with the General Conditions. These specifications may extend the period of the guarantee for certain items. Where such extensions are called for, or where items are normally provided with guarantee periods in excess of that called for in the General Conditions, the Certificate of Guarantee shall be furnished to the Owner through the Engineer.

1.6 EXAMINATION OF SITE

A. The Contractor shall examine the site, compare it with plans and specifications, and shall have satisfied himself as to the conditions under which the work is to be performed. No allowance shall subsequently be made in his behalf for any extra expense to which he may be put due to failure or neglect on his part to make such an examination.

1.7 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Shop Drawings: Within 30 days of contract award, the Contractor shall submit six copies of shop drawings for all materials, equipment, etc. proposed for use on this project. Material and equipment shall not be ordered or installed until written review is processed by the Engineer. Any item omitted from the submittal shall be provided as specified without substitution. All shop drawings must comply with the following:
   1. Shop drawings are required for all material and equipment items and shall include manufacturer's name and catalog numbers, dimensions, capacities, performance curves, and all other characteristics and accessories as listed in the specifications or on the drawings. Descriptive literature shall be current factory brochures and submittal sheets. Capacities shall be certified by the factory.
   2. All shop drawings shall be submitted at one time in a neat and orderly fashion in a suitable binder with title sheet including Project, Engineer and Contractor; Table of Contents; and indexed tabs dividing each group of materials or item of equipment. All items shall be marked with the specification paragraph number for which they are proposed. All equipment shall also be identified by the mark number as indicated on the drawings.
   3. All capacities, characteristics, and accessories called for in the specifications or on the drawings shall be highlighted, circled, or underlined on the shop drawings. Calculations and other detailed data indicating how the item was selected shall be included for items that are not scheduled. Data must be complete enough to permit detailed comparison of every significant characteristic which is specified, scheduled, or detailed.

C. Substitutions: Manufacturers and model numbers listed in the specifications or on the drawings represent the standard of quality and the features desired. Unless otherwise noted, alternate manufacturers may be submitted for review by the Engineer. Calculations and other detailed data indicating how the item was selected shall be included. The Contractor shall assume full responsibility that substituted items or procedures will meet the specifications and job requirements and shall be responsible for the cost of redesign and

modifications to the work caused by these items.

D. Review: Submittals will be reviewed for general conformance with the design concept, but this review does not guarantee quantity shown, nor does it supersede the responsibility of the Contractor to provide all materials, equipment, and installation in accordance with the drawings and specifications. The Contractor shall agree that shop drawing submittals processed by the Engineer are not Change Orders; that the purpose of shop drawing submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept; that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. The Contractor shall agree that if deviations, discrepancies or conflicts between shop drawings and design drawings and specifications are discovered either prior to or after shop drawing submittals are processed by the Engineer, the design drawings and specifications shall control and shall be followed.

1.8 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Submit one electronic pdf copy for review and after approved submit three hard copies of the Operation and Maintenance Instructions and Wiring Diagrams for all equipment and parts lists for all equipment, etc. shall be submitted to the Engineer. All instructions shall be clearly identified by marking them with the same designation as the equipment item to which they apply (e.g. WH-1). All wiring diagrams shall agree with revised shop drawings and indicate the exact field installation. All instructions shall be submitted at the same time and shall be bound in a suitable binder with tabs dividing each type of equipment (e.g. Water Heaters, Pumps, Motors, etc.). Each binder shall be labeled indicating "Operating and Maintenance Instructions, Project Title, Contractor, Date" and shall have a Table of Contents listing all items included. **(These submittals shall be submitted with regular submittals at start of job so Commissioning Contractor can start on the commissioning check list for Title 24 Requirements)**

B. Verbal: The Contractor shall verbally instruct the Owner's maintenance staff in the operation and maintenance of all equipment and systems. The controls contractor shall present that portion of the instruction that applies to the control system. The Engineer's office shall be notified 96 hours prior to this meeting.

C. Acknowledgment: The Contractor shall prepare a letter indicating that all operation and maintenance instructions (printed, verbal and posted) have been given to the Owner, to the Owner's satisfaction. This letter shall be acknowledged (signed) by the Owner and submitted to the Engineer.

1.9 RECORD DRAWINGS

A. The Contractor shall maintain a set of prints for the project as a record of all construction changes made. As the Work progresses, the Contractor shall maintain a record of all deviations in the Work from that indicated on the drawings. Final location of all underground work shall be recorded by depth from finished grade and by offset distance from permanent surface structures, i.e. buildings, curbs and walks. In addition, the water, gas, sewer, etc. within the building shall be recorded by offset distances from building walls. The original drawings will be made available to the Contractor from which he shall have a set of reproducible drawings made. The Contractor shall then transfer the changes, notations, etc. from the marked-up prints to the reproducible drawings. The record drawings (marked-up prints and reproducibles) shall be submitted to the Engineer for review (as an alternative, the marked-up prints may be photocopied full size on reproducible stock).

PART 2 PRODUCTS

2.1 PROTECTIVE COATING FOR UNDERGROUND PIPING

A. All ferrous pipe below grade (except cast iron) shall have a factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness, X-Tru Coat, Scotchkote. All fittings and areas of damaged coating shall be covered with two layer double wrap of 10 mil polyvinyl tape to total thickness of 40 mils. Manville Corporation. Protective coating shall be extended 6" above surrounding grade.

2.2 CONCRETE ANCHORS

A. Concrete Anchors shall comply with CBC 1901A.3. Steel stud with expansion anchor requiring a drilled hole; powder driven anchors are not acceptable. Minimum concrete embedment shall be 4-1/2 diameters. Minimum spacing shall be 10 diameters center-to-center and 5 diameters from center to edge of concrete. Maximum allowable stresses for tension and shear shall be 80% of the test report values "with special inspection". Anchors shall be Hilti, Philips - or Approved equal.

2.3 SEISMIC RESTRAINTS

A. All plumbing systems (all equipment, piping, etc.) shall be provided with seismic restraints in accordance with "Seismic Restraint Systems Guidelines” OPM-0052-13 by Eaton/ Tolco.

2.4 SYSTEM IDENTIFICATION

A. Above Grade Piping: Provide markers on piping which is either exposed or concealed in accessible spaces. For piping systems, other than drain and vent lines, indicate the fluid conveyed or its abbreviation, either by preprinted markers or stenciled marking, and include arrows to show the direction of flow. Comply with ANSI A13.1 for colors. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where lines pass through floor, walls or ceilings or otherwise pass into inaccessible spaces, and at 50' maximum intervals along exposed portion of lines. Marking of short branches and repetitive branches for equipment connections is not required.

B. Equipment: All equipment shall be identified with a plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. WH-1). Provide 1/2" high lettering, white on black background. Nameplates shall be permanently secured to the unit.

C. Valves: Provide valve tags on all valves of each piping system, excluding check valves, valves within equipment, faucets, stops and shut-off valves at fixtures and other repetitive terminal units. Provide brass tags or plastic laminate tags. Prepare and submit a tagged valve schedule, listing each valve by tag number, location, and piping service. Mount in glazed frame where directed.

2.5 EQUIPMENT SUPPORT FRAMES

A. Unless specifically noted otherwise, it shall be the responsibility of Plumbing Contractor to furnish and install all support frames for its equipment.

PART 3 EXECUTION

3.1 SCHEDULING OF WORK

A. All work shall be scheduled subject to the approval of the Engineer and Owner. No work shall interfere with the operation of the existing facilities on or adjacent to the site.

3.2 CONDUCT OF WORK

A. The Contractor shall have at all times, as conditions permit, a sufficient force of workmen and quantity of materials to install the work contracted for as rapidly as possible consistent with good work and shall cause no delay to other Divisions engaged upon this project or to the Owner.

B. Plumbing Contractor shall arrange for all cutting necessary for the proper installation of its work, providing all sleeves and chases necessary. Cutting shall not be done in such a manner to impair the strength of the structure. Any damage resulting from work shall be repaired by the Contractor at his expense to the satisfaction of the Engineer.

C. Progressively, daily at the completion of each day's work, and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.

D. **IAQ Management plan will be in effect for Cal Green requirements. Adhesives and mastic must comply with low VOC requirements and documentation (MSDS, etc.) shall be provided with submittals.**

3.3 EXCAVATION AND BACKFILL

A. Excavation: Trenches are to be excavated to grade and depth established by drawings. Unless otherwise noted, minimum earth cover above top of pipe shall be 24", not including base and paving in paved areas. Width of trenches at top of pipe shall be a minimum of 16" plus the outside diameter of the pipe. Provide all shoring required by site conditions. Barrel of pipe shall have uniform support on trench bottom, hand excavate additional depth at bells, hubs, and fittings. Where over-excavation occurs, provide compacted selected backfill to pipe bottom. Where ground water is encountered, remove to keep excavation dry, using well points and pumps as required.

B. Backfill:
1. Around Pipe and to One Foot Above Pipe: Material shall be river run sand or native granular free flowing material, free of clay lumps, silt or vegetable matter and shall have 100% passing through the No. 4 sieve and a maximum of 3% passing through the No. 200 sieve. Place carefully around and on top of pipe, taking care not to disturb piping. Consolidate with vibrator.
2. One Foot Above Pipe to Grade: Material to be sandy or silty loam, free of lumps, laid in 6" layers, uniformly mixed, to proper moisture and compacted to required density. If backfill is determined to be suitable and required compaction is demonstrated by laboratory test, water compaction in 6" layers may be used, subject to approval by the Engineer.
3. Remove all water sensitive settlement from trench backfill regardless of location and compaction requirements.

C. Compaction: Compact to a density of 95% within building and 90% outside building. Demonstrate proper compaction by testing at one-half of the trench depth. Perform three tests per 100' of trench.

3.4 OPENINGS, CUTTING AND PATCHING

A. The locations and dimensions for openings through walls, floors, ceilings, foundations, footings, etc. required to accomplish the work under this Specification Division shall be provided under this Division. The actual openings and the required cutting and patching shall be provided. Coring through existing concrete or masonry walls, floors, ceilings,

foundations, footings, etc., and saw cutting of concrete floors or asphaltic concrete required to accomplish the work under this Specification Division shall be provided under this Division. Patching of these surfaces shall also be provided. Cutting and coring shall not impair the strength of the structure. Any damage resulting from this work shall be repaired at the Contractor's expense to the satisfaction of the Engineer.

3.5 MANUFACTURER'S RECOMMENDATIONS

A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of a particular item. The Contractor shall be responsible for all installations contrary to the manufacturer's recommendations. The Contractor shall make all necessary changes and revisions to achieve such compliance. Manufacturer's installation instructions shall be delivered to and maintained at the job site through the construction of the project.

3.6 QUIETNESS

A. Piping and equipment shall be arranged and supported so that vibration is a minimum and is not carried to the building structure or spaces.

3.7 DAMAGES BY LEAKS

A. The Contractor shall be responsible for damages to other work caused by leaks in the temporary or permanent piping systems prior to completion of work and during the period of the guarantee, and for damages to other work caused by disconnected pipes or fittings, and the overflow of equipment prior to completion of the work.

3.8 CLEANING

A. Progressively and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.

END OF SECTION 22 00 00

SECTION 22 00 01 - PLUMBING 5

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PART 1 GENERAL

1.1 GENERAL CONDITIONS

A. The foregoing Section 22 00 00, General Plumbing Provisions shall form a part of this specification.

1.2 SCOPE

A. Included: Perform all work necessary and required to complete construction as indicated. Such work includes the furnishings of all labor, materials, and services necessary for a complete, lawful, and operating plumbing system with all equipment as shown or noted on the drawings or as specified herein. The work includes, but is not necessarily limited to, the following:
1. Sanitary sewer system.
2. Domestic water system.
3. Plumbing fixtures.
4. Plumbing equipment.
5. Condensate drains.
6. Storm drain system.
7. Gas piping.

B. Work Specified Elsewhere:
1. Line voltage power wiring (60 volts or greater), motor starters in motor control centers, and disconnect switches are included in the Electrical Division, unless otherwise noted.
2. Access doors.
3. Concrete and reinforcing steel.
4. 23 00 01, Heating, Ventilating and Air Conditioning.

1.3 CODES AND STANDARDS

A. All pipe, pipe or plumbing fittings or fixture, solder, or flux shall be lead free that provides water for human consumption per California Assembly Bill 1953 (AB1953).

B. See Section 22 00 00 for additional requirements.

1.4 SUBMITTALS

A. Provide product data for all materials per Division 01.

PART 2 MATERIALS

2.1 PIPING MATERIALS

A. Sanitary Sewer:
1. Soil, Waste and Vent Piping:
a. Inside Building and Within Five Feet of Building Walls: Standard weight coated cast iron pipe and fittings. Plain end with neoprene gasket and stainless steel retaining sleeve, CISPI 301, ASTM A888 hubless cast-iron, or hub end with rubber gasket, ASTM A74, ASTM C564. Size 2” and smaller above grade may be standard weight galvanized steel, ASTM A53, with coated cast iron recessed drainage

fittings, ANSI B16.12. All cast iron pipe and couplings shall be American made and tested, no imported pipe or coupling is acceptable. Use heavy-duty (4-Band) couplings for all soil and waste piping. Use standard (2-Band) couplings for all vent piping. Tyler Pipe, AB & I Foundry or Charlotte Pipe. Couplings shall be Tyler, Anaco or Husky.

1) Piping over food prep centers, food serving facilities, food storage areas and other critical areas shall be kept to a minimum and shall not be exposed.

b. Outside Building:
   1) For domestic waste only: Polyvinyl chloride gravity sewer pipe with bell and rubber Z-gasket, ASTM D3034, SDR 35. Carlon, J.M.
   2) PVC-DWV sewer pipe with solvent weld, ASTM D2665. Schedule 40 wall thickness. Traps, sink outlets, cleanouts, etc., shall be same material. Traps shall have union connections.
   3) Where cover is less than 15", pipe shall be cast iron, same as for inside of building.

2. Cleanouts: Floor cleanouts: Smith 4020 with nickel bronze top in finished areas; Smith 4220 in utility areas. Wall cleanouts: Smith 4530 with stainless steel cover and screw. Comparable models of Josam, Wade, Zurn or equal.
3. Cleanout Box: Precast reinforced concrete. Cast iron lid marked for service. Christy or equal; F22 in foot traffic area; G5 in roadways.

B. Storm Drain:
1. Piping:
   a. Inside Building and Within Five Feet of Building walls: Same as Soil, Waste, and Vent Piping.
   b. Outside Building:
      1) 10" and Smaller: Standard strength non-reinforced concrete bell and spigot, ASTM C14, or Polyvinyl chloride gravity sewer pipe with bell and rubber Z-gasket, ASTM D3034, SDR 35. Carlon, J.M. Where cover is less than 15", same as for inside building.
      2) 12" and Larger: Reinforced concrete, Class III, 2000 D-load, ASTM C76.
      3) Fittings: Fittings and couplings shall be specifically designed for the type of pipe used. Fittings and couplings designed for perforated or under drain piping will not be allowed.

C. Water and Gas:
1. Hot and Cold Water & Piping:
   a. Inside Building: Type L hard temper seamless copper, ASTM B88. Wrought copper fittings ANSI B16.22. 95/5 tin-silver soldered joints. Brazesafe, Silcan or equal brazing material.
   b. Outside Building Below Grade: Same as Inside Building with protective coating on ferrous pipe or Schedule 40 PVC pipe thru 2", Class 315 2" thru 4".
2. Gas Piping:
   a. Above Grade: Schedule 40 black steel pipe, ASTM A53. 150 psi black malleable iron screwed fittings, ANSI B16.3, ANSI B31.8. Galvanized pipe and fittings will not be allowed. Flexible connections shall be convoluted brass with dielectric couplings, AGA approved. Outside building flexible connections shall be convoluted stainless steel with dielectric couplings, AGA approved. Prime and paint all piping.
   b. Outside Building – Below Grade: Same as Inside Building – Above Grade, with protective coating of ferrous pipe or medium density polyethylene (MDPE) PE2708 or PE2406 pipe manufactured in accordance with ASTM D2513 and IAPMO Standards.

D. Condensate Drain Piping: Same as cold water piping.

E. Valves and Specialties:
1. Valves:
a. General: Manufacturer's model numbers are listed to complete description. Milwaukee, Kitz, Apollo, Nibco, Stockham or equal. All valves shall be full size of upstream piping. **Ball valves shall be substituted for gate valves 2" and smaller. Butterfly valves shall be substituted for gate valves 2-1/2" and larger. C_V factors for ball valves shall not be less than equal size gate valves.**
b. Check Valve: 2" and smaller: All bronze swing check, regrinding. 200 psi WOG. Milwaukee No. 509, 1509 or equal. 2-1/2" and larger: Non-slam type, 125 psi iron body wafer type with renewable seats and stainless steel spring. Milwaukee 1400 series or equal.
c. Plug Valve: Eccentric bronze plug. Nickel chromium alloy iron body. Bronze bushings. Buna-N O-rings. UL approved for gas distribution. 175 psi WOG. DeZurick Series 400 or equal.
d. Ball Valves: Two or three piece construction, forged bronze body, chrome plated brass ball, threaded ends, teflon seats, PTFE or reinforced teflon stem seals, lever handle. Underground valves shall have “T” handle. Provide one operating “T” extension handle for all underground valves. Milwaukee BA100/150, BA300/350, Nibco or equal.
e. Gas Valves: 2" and smaller, Milwaukee BB2-100; 2-1/2" and larger, Rockwell #142 or equal.
f. Valve Box: Precast reinforced concrete. Cast iron lid marked for service. Christy or equal; F22 in foot traffic areas: G5 in roadways.
g. Butterfly Valve: Iron Body, Aluminum bronze disk (connection to shaft shall not be by pins, screws, or bolts). Ductile body PPS coated with EPPM coated ductile disc. O-ring seals. Resilient removable seat. 416 stainless steel two piece shaft. 6” and smaller valves shall have multi-position lever handle. Underground valves shall have square operating nut. Provide one operating “T” handle for underground valves. Provide 2” extension neck at insulated pipes. Milwaukee “C” series, Kitz or equal.
2. Miscellaneous Specialties:
a. Temperature and Pressure Relief Valve: ASME rated fully automatic, reseating combination temperature and pressure relief valve sized in accordance with energy input. Sensing element immersed within upper 6" of tank. Watts.
b. Union: 2" and Smaller: AAR malleable iron, bronze to iron ground seat. 300 psi.
c. Dielectric Coupling: Insulating coupling rated for 250 psig. EPCO or equal.
d. Shock Absorbers: Sioux Chief “Hydra-Rester”, Zurn “Shoktrol”, PPP “SC Series” or equal.

F. Flue Piping:
1. Gas Flue Piping: Flue pipe shall be type as recommended by equipment manufacturer for which the pipe is connected to. UL listed. Metalbestos, Amerivent or equal.
2. Flue Cap: Designed to properly ventilate flue regardless of wind direction. Storm proof, bird proof. Metalbestos, Amerivent or equal.

G. Miscellaneous Piping Items:
1. Pipe Support:
a. Pipe Hanger: Adjustable split ring, swivel hanger and rod. Black malleable iron. Size and maximum load per manufacturer's recommendation. Felt lined, B-Line B3690F, Unistrut or equal.
b. Construction Channel: 12 gage 1-5/8" x 1-5/8" steel channel. Single or multiple section. Self-locking nuts and fittings. B-Line, Unistrut, Superstrut or equal.
2. Pipe Sleeves: 24 gage galvanized steel. Adjus-to-Crete #10 with #99 thimble for floors. #100 for walls.
3. Flashing: Vent flashing and flashing for piping through roof shall be prefabricated 24 gauge galvanized steel roof jacks with 8" square flange around pipe. For tile or other

roofing systems where pliable flashing is required, flashing shall be lead. Seal with weatherproofing mastic.

2.2 PIPING INSULATION MATERIALS

A. General: All piping insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.

B. Pipe Insulation: Elastomeric type, ASTM C534, with a thermal conductivity of 0.27 at 75°F when measured in accordance with ASTM C177 or ASTM C518.
1. Wall thickness: 3/4 in.
2. Adhesive: Conform to Manufacturer's recommendations.

C. Pre-molded Fiberglass: Heavy density sectional pre-molded fiberglass with vapor barrier laminated all-service jacket and pressure sealing vapor barrier lap. Thermal conductivity shall not exceed 0.25 Btu-in/hr-sq. ft-degrees F, at a mean temperature of 50 degrees F. Perm rating 0.02, ASTM E96. Puncture rating 50 Beach units, ASTM D781. Provide 3" (min.) wide tape of same material as lap for butt joints. For hot water piping, thickness shall be 1" for pipe sizes less than 2", 1-1/2" thickness for pipe sizes 2" and larger. CSG Insulation Corp., Manville, Owens-Corning or equal.

D. Fiberglass Blanket: Unfaced. Thermal conductivity shall not exceed 0.25 Btu-in/hr sq. ft-degrees F, at a mean temperature of 50 degrees F. 1-1/2" thickness. Manville, Owens-Corning or equal.

E. PVC Jacket (for exposed pipes and fittings): Pre-molded polyvinyl chloride (PVC) jackets. Size to match application. Provide PVC vapor barrier, pressure-sealing tape by same manufacturer. Zeston or equal.

2.3 FIXTURES

A. General: This Division shall rough-in for and install all plumbing fixtures shown on drawings. All trim not concealed shall be brass with polished chromium plate finish unless otherwise noted. All enameled fixtures shall be acid resisting. Standard color is white unless otherwise noted.

B. Schedule: Refer to Plumbing Fixture Schedule on the drawings for list of fixtures. Manufacturer's model numbers are listed to complete description. Water consumption quantities listed on schedule are maximum. Equivalent models of American Standard, Crane, Haws, Kohler, Eljer, Zurn or equal. For drainage fixtures, equivalent models of Josam, Smith, Wade, Zurn or equal.

C. Stops and P-traps: All fixtures shall be provided with stops and p-traps as applicable.
1. Stops: All hot and cold water supplies shall be 1/2" angle stops with IPS inlets and compression outlets, stuffing box, screwdriver lock shield, and 1/2" flexible brass tubing riser. Speedway. Wall mounted trim shall have concealed loose key wall stop. Chicago 1771 or equal.
2. P-traps: Brass, ground joint. 17 gage. American Standard, California Tubuler or equal.
   a. Trap primers shall be provided with ball valve and cylinder key-lock access panel for all floor drains and floor sinks. PPP, Inc. or equal.

2.4 EQUIPMENT

A. General Requirements:
   1. General: These equipment specifications are to supplement the drawings. Refer to schedules on drawings for the specific equipment to be provided. Capacities shall be in accordance with the schedules shown on the drawings. Capacities are to be considered minimum.
   2. Dimensions: Equipment must conform to space requirements and limitations as indicated on the drawings and as required for operation and maintenance. Equipment will not be accepted that does not readily conform to space conditions.
   3. Ratings: Electrical equipment shall be in accordance with NEMA Standards and UL listed where applicable standards have been established.
   4. Basis of Design: Manufacturers and model numbers listed in schedules as the basis of design are intended to represent the standard of quality and the features desired.
   5. Piping: Each item or assembly of items shall be furnished completely piped for connection to services. Control valves and devices shall be provided. Equipment requiring domestic water for non-potable use shall be provided with backflow preventer acceptable for intended use by local governing authorities.
   6. Electrical:
      b. General: Each item or assembly of items shall be furnished completely wired to individual terminal blocks for connection to single branch electrical circuit. All electrical accessories and controls required by equipment shall be furnished. Provide terminal blocks for controls not included in equipment package. Manual and magnetic starters shall have ambient compensating running over-current protection in all ungrounded conductors. Magnetic starters shall be manual reset. Controllers and other devices shall be in NEMA 3 or 12 enclosures as applicable.
      c. Wiring: Conductors, conduit, and wiring shall be in accordance with Electrical Specifications. Individual items within assembly shall be separately protected with dead front, fused disconnect, fuse block, or circuit breaker for each ungrounded conductor, all accessible on operating side of equipment. Switches, contacts, and other devices shall be in ungrounded conductors.
      d. Motors: Shall be rated, constructed, and applied in accordance with NEMA and ANSI Standards without using service factor. Single-phase motor shall be of type to suit application. Three-phase motors shall be open drip-proof, NEMA B design on pumps and fans, NEMA C on reciprocating equipment, sealed ball bearing, three-phase induction. Design shall limit starting inrush current and running current to values shown on drawings.
      e. Starters: Motor starters shall be provided for all equipment except where starter is in a motor control center as designated on the electrical drawings.
      f. Control Voltage: Equipment connected to greater than 240 volts shall be provided with 120 volt transformer if separate source is not indicated on plans. 240 volt control is acceptable if confined within control panel.
      g. Submittals: Included in shop drawings shall be internal wiring diagrams and manufacturer's recommended external wiring.

B. Electric Drinking Fountain: Wall hung, Dual height with Bottle Filler. Provide steel mounting brackets. Stainless steel basin. Removable grid drain. Chrome plated brass bubbler with automatic flow regulator and self-closing valve. Nonferrous evaporator. Hermetic compressor with automatic reset overload protection. Air cooled condenser. Adjustable thermostat. UL listed. ARI certified. Elkay or approved equal.

C. Water Heater, Gas: Glass lined tank. 150 psi working pressure. Fully insulated. Automatic temperature control. High limit control. Provide ASME rated temperature and pressure relief valve sized in accordance with energy input, dielectric couplings and drain cock. AGA and CEC approved. Extended warranty for a period of 5 years minimum. State, A.O. Smith, National , Rheem or equal.

D. Water Heater, Electric: Glass lined tank. 150 psi working pressure. Fully insulated.

Automatic temperature control. High limit control. Provide ASME rated temperature and pressure relief valve sized in accordance with energy input, dielectric couplings and drain cock. UL listed and CEC approved. Extended warranty for a period of 3 years minimum. State, A.O. Smith, National, Rheem or equal.

E. Pressure Booster System:
1. General:
   a. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
   b. All materials that may come in contact with the potable water delivered shall comply with ANSI/NSF Standard 61 and the “complete system” shall be certified as constructed. Individual component certification is not compliant.
   c. Pressure ratings of pumps, pipe, fittings, valves, gauges, and all other water carrying appurtenances shall be suitable for the anticipated system pressures in which they are installed. Headers shall be constructed of 304 stainless steel at a minimum.
   d. The Contractor shall ascertain for himself the space and access available for the installation of a factory assembled pre-packaged and tested unit. All components of the system shall be compatible and be furnished by a single source manufacturer and all electrical services and interconnecting equipment wiring must be provided for a complete assembly with a single-source, fused power disconnect and water connections.
   e. The entire system shall be factory skid mounted on a minimum 304 stainless-steel structural square tube support frame, with in-shear molded rubber vibration isolators in compliance with standards as required in installation instructions published by pump manufacturer. Suction and Discharge Headers must be supported by pump skid frame to prevent piping strain on the pump casing and during system transport. No Exceptions.
   f. System must meet ANSI/ASHRAE/IES 90.1, Section 10.4.2, “Energy Standard for Buildings” and have proof of compliance utilizing either remote sensor option or software logic which adjusts set point according to flow rate.
   g. For isolation valve sizes 2" and smaller, valves shall be full port bronze ball valves with integral union, compliant ball, and stem design. For isolation valve sizes 2.5" and larger, valves shall be epoxy coated ductile iron lever operated lug type butterfly valves with stainless steel disc and stainless steel shaft. Valves must be rated for maximum pressure service for the system and also comply with NSF 61 & 372 Drinking Water requirements.
   h. Unions or flanges shall be provided for easy removal of pumps. System headers shall be sized for a velocity not exceeding 10 FPS at full flow and shall be terminated with a groove or flanged joint capable of accepting a groove coupling ANSI flange or groove flange furnished by Contractor.
   i. The packaged pumping system shall include all electrical wiring between components and shall be completely flow and pressure tested for actual site conditions at the factory prior to shipment.
   j. System shall be arranged such that single point connections are required for piping and electrical power supply. Multiple power connections are un-acceptable.
   k. Individual pumps, motors and check valves shall be serviceable with the booster system in operation utilizing isolation valves for each pump.
   l. Refer to schedules on Contract Drawings for required pump capacities and electrical characteristics.
2. Acceptable Manufacturers:
   a. The following manufacturers are acceptable provided their products meet or exceed these Specifications and the Contract drawing schedules. Equal product compliance certification must include a signed letter from the manufacturers’ owner or officer indicating products are in full compliance with all aspects of this

specification as written:
1) QuantumFlo.
2) Approved equal to these specifications with 10-day prior approval from the Engineer and Letter of Certification.

3. Pumps and Motors:
   a. System shall include vertical or horizontal mounted stainless steel, close-coupled, end suction centrifugal pumps with NPT threaded or ANSI flanged connections. Pump features to include stainless steel casing, back pull out design, top centerline discharge and hydraulically balanced stainless steel impeller with ceramic-carbon seal minimum. Pump shall be hydro-formed for maximum efficiency with stainless steel fitted construction and a replaceable shaft sleeve and mechanical seal.
   b. Motor shall be NEMA Premium Efficiency, Class F Insulated, Inverter duty, close-coupled type with a J, JM, or TC type motor. Motors shall be TEFC enclosed and manufactured in accordance with NEMA standards for the voltage, frequency and phasing indicated on the pump schedule or plans.
   c. Motors shall be premium efficiency in accordance with DOE June 2016 requirements. Motors shall have ball bearings and operate at 40° ambient. Each motor shall be equipped with the manufacturer's nameplate and shall have a sufficient horsepower rating to operate the pump at any point on the pump's head-capacity curve without overloading the nameplate horsepower rating of the motor. The motor shall have a service factor of 1.15 for variations in voltage and frequency.
   d. Pumps and motors larger than 5 H.P. shall be mounted with rubber-in-shear isolators to reduce vibration and stress into the baseplate, machine and system piping as required.
4. Variable Frequency Drives:
   a. System shall feature variable frequency drives of the PWM design suitable for variable torque applications using any standard NEMA Design B squirrel cage induction motor. Variable frequency drives shall be sized for the maximum possible amp draw throughout the programmed sequence of pump operation.
   b. Drives shall be pulse width modulated, start into a rotating load, follow signal from logic section of control panel when in auto mode and be provided with the following features:
      1) Hand/off/auto switch and manual speed adjustment if auto system is inoperable.
      2) Auto Drive Shutdown for electrical fault.
      3) Automatic restart after power fails shutdown.
      4) Complete service diagnostics with fault history log up to 6 events.
   c. Keypad Operator Device including the following:
      1) Backlit LCD Display.
      2) Power On and Alarm/Fault Displays.
   d. Operational data displays include:
      1) Drive Speed [HZ]
      2) Motor Torque [%]
      3) Input Power [kW]
      4) Current [A]
      5) Elapsed Time [Hours]
      6) Motor Voltage [V]
   e. No electrical A-T-L (across the line) bypass shall be provided with any drive as the VFD is the only mode of pressure control.
   f. Drives shall be controlled via a Master/Slave control arrangement where the controller makes all adjustments via a high-speed interface which provides for greater PID resolution and PID auto-tuning. Exceptions to this requirement must be approved via pre-approval documentation with the engineer proving their energy-efficiency to the standard set forth.
5. Pressure Sensor/ Transmitter:

a. Provide suction and discharge, Type 4X, stainless-steel pressure sensors/transmitters and internal separate pressure switch with integral event-logger, which provides a 4-20 mA signal output, compatible with the system controls, temperature, and pressure requirements. Pressure sensor/transmitter shall have zero, span and damping devices. The transmitter shall be installed on the system suction and discharge headers and factory wired to the control circuitry. Sensor shall feature a high contrast LED readable from a 6-foot distance by maintenance personnel. When high-contrast LED transmitters are provided, other gauges or sensors are redundant and un-necessary.

6. Sequence of Operation:
   a. The lead pump shall run only as necessary to maintain system pressure and will be controlled automatically by means of the pressure sensor/transmitter and programmable logic controller (PLC) designed to prevent short cycling and provide sensor-less flow detection. If the lead pump is unable to maintain system pressure the lag pump(s) will be called on as required by the sensor-less flow algorithm and will operate in parallel with the lead pump until no longer necessary and be sequenced off. When one pump can handle the system demand the controls will optimize energy consumption by eliminating the lag pump from sequence. When a low or no-flow condition is reached the system shall revert to the stand-by mode if no flow is present via an intelligent flow detection algorithm, which does not raise the set pressure to charge a tank to detect low flow. These systems DO NOT require a hydro-pneumatic tank installed and thereby does not raise the system pressure set point. (See 2.08) Note: Raising system pressure to charge a tank violates ANSI/ASHRAE/IES Standard 90.1 by raising the pressure in lieu of maintaining constant system pressure.
   b. An empty pipe condition is to be determined by an algorithm allowing for a slow ramp to set point to prevent system pressure shocks. The “pipe-fill” algorithm will also prevent VFD “wind-up” and pressure spikes associated with this condition.
   c. The system shall employ software to detect pipe break and stop system, initiate an alarm and log the event. In the event of a sensor failure, the system shall run one pump in a semi-automatic mode allowing the building to maintain a minimum pressure until the sensor can be repaired or replaced.
   d. An auto-tuning PID algorithm shall continuously monitor system pressure and maintain steady-state system pressure as demand load changes rapidly and pump moves horizontally on its plumbing-performance curve. The PID algorithms shall incorporate intelligent algorithms to start the pumps at the point of creating pressure saving energy and reducing time to set pressure upon pump call.
7. Control Panel:
   a. Logic Section - Provide, mount and wire on the skid a programmable logic controller in a NEMA 3R, splash-proof, forced-air ventilated enclosure to fully contain all VFD’s and interface the signal from the pressure sensor to the VFD's and provide a stabilized response to speed up or slow down or add pumps to meet system requirements. The controller shall provide set point adjustment, timer adjustment, PID functions (as required) and both system and controller self-diagnostics via touch screen display. The HMI Screen shall feature an LED backlight, analog resistive, IP65/NEMA 4X, 2 GB eMMC Flash memory, rated 0-55 Degrees C with alarm logging and real-time, internal clock, Intel® Atom™ E620T 333 MHz clock speed. The touch screen display/human machine interface shall include a 7” TFT WVGA, 16.7 million color, 800x480 Pixels, resistive analog display with RS232/485 ports, Optional Ethernet (OPC-UA) and USB Ports for Upload/Download of system trend data.
   b. All user interface set points shall be easily accessible via a password protected display screen. The password shall be of the “rolling” type to prevent un-authorized access to factory settings. Normal system operation shall be auto-tuned to eliminate pressure hunting. Controller shall feature an (optional) USB Download connection which allows user to download trending analysis without the

need for a formal BAS connection. All system data and settings shall be accessible from the display without the need to access the high-voltage controller internals. The software shall include clear alarm indications and user troubleshooting wizards to ascertain and correct all system alarms and conditions.

c. Power Section – The internally touch-safe, high voltage controller with HMI shall be factory wired and mounted on a structural square-tube frame, stainless steel system skid. The panel shall be furnished with single-point power connection, fused main disconnect switch with a single door mounted and interlocked handle, each VFD shall be protected by a fused branch compact circuit protector. Multiple power source connections are un-acceptable. A 24-volt DC power supply shall be provided for logic, sensors, and fan circuitry where necessary. Controller shall feature the following minimum additional components:
   1) UL 1449 Type I Surge Arrestor with active over-voltage control via MOV's (metal oxide varistors). Passive surge or lightning arrestors are not acceptable.
   2) Low suction pressure shutdown circuit with auto reset and alarm logging.
   3) High system pressure shutdown circuit with auto reset and alarm logging.
   4) System key-logger which records all keypad entries stored in non-volatile memory. (downloadable)
   5) Audible alarm with silence push button and alarm log recognition of reset.
   6) Auto-alternate all pumps automatically on each stand-by cycle.
   7) 24 hour pump exerciser function which runs exercises pumps to maintain seal lubrication when the pump has not been started in the previous 24 hours.
   8) Auxiliary relay contacts for all alarm conditions or discreet data monitoring capability.
   9) Audible and visual indication of low storage tank level, with silence push button. (when optional suction break-tank is used)
   10) Elapsed time meters, system pressure, KW and other critical values, portable to system SCADA via discrete communication.
   11) Pipe Break Alarm with auto-shut down and time/date alarm logging of event.
   12) Table chart indicating system pressure and system KW with optional direct to USB Flash download for the most recent 1-week events, time and date stamped.
   13) The system shall not require external flow meters or KW monitoring. The system will not implement speed, thermal or time delay means to detect and shut down pumps on a no demand condition as this wastes energy and provides for unnecessary run times.
   14) System must feature ANSI/ASHRAE/IES Energy Standard 90.1 compliance via either a remote mounted pressure sensor or internal system logic which detects low flow and automatically adjusts set point according to piping losses at the condition with auto reset.
   15) As per current CEC 2017, Section 409.110, control panel MUST have a listed minimum SCCR value, equal to or greater than the available fault current of the feeder circuit. A coordination study must be completed and furnished by the electrical designer or contractor to verify available fault current against the connected equipment.

8. Start-Up Service:
   a. The service of a factory trained representative shall be made available on the jobsite for start-up and instructing operating personnel. Notify the Engineer 2 days prior to the start-up.

F. Circulation Pump: Bronze pump with stainless steel or non-metallic impeller. Shaft shall be stainless steel or ceramic with carbon bearings with EPDM O-ring and gaskets. Replaceable cartridge type circulators shall have stainless steel cartridge. Connections shall be sweat, threaded, or flanged. Taco, Bell & Gossett, Grundfos, Armstrong or equal.

PART 3 EXECUTION

3.1 PIPING INSTALLATION

A. General:

1. Piping Layout: Piping shall be concealed in walls, above ceilings, or below grade unless otherwise noted. Exposed piping shall run parallel to room surfaces; location to be approved by Owner's Representative. No structural member shall be cut, notched, bored, or otherwise altered unless specifically allowed by structural drawings and/or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed. All piping shall be installed in a manner to ensure unrestricted flow, eliminate air pockets, prevent any unusual noise, and permit complete drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment. Expansion joints shall be installed as required. Vertical lines shall be installed to allow for building settlement without damage to piping. All exposed piping to be primed and painted, see painting section.
2. Joints:
   a. Threaded: Pipe shall be cut square and reamed to full size. Threads shall be in accordance with ANSI B2.1. Joint compound or tape suitable for conveyed fluid shall be applied to male thread only. Joints shall be made with three threads exposed.
   b. Welded or Brazed: Filler rod shall be of the same suitable alloy as pipe. Welding or brazing shall be performed in accordance with requirements of recognized published standards of practice and by licensed or otherwise certified contractors. Welder or Brazer shall be a person who specialized in welding or brazing of pipes and holds a recognized certificate of competency from a recognized testing laboratory, based on the requirements of the ASME Boiler and Pressure Vessels Code, Section 9.
   c. Other: Joints other than threaded or welded shall be installed in accordance with manufacturer's recommendations.
   d. Open Ends: Open ends of piping shall be capped during progress of work to preclude foreign matter.
   e. Electrical Equipment: Joints shall be avoided, where possible, over electrical equipment.
   f. Copper pipe 1-1/2" or less may be soldered. Above 1-1/2" and all below grade shall be brazed.
3. Fittings:
   a. Standard Fittings: All joints and changes in direction shall be made with standard fittings. Close nipples shall not be used.
   b. Reducers: Pipe size reduction shall be made with bell reducer fittings. Bushings shall not be used.
   c. Unions: A union shall be installed on the leaving side of each valve, at equipment connections, and elsewhere as necessary for assembly or disassembly of piping.
   d. Valves: All valves shall be full line size. At equipment connections, valves shall be full size of upstream piping.
4. Pipe Support:
   a. General: Hangers shall be placed to support piping without strain on joints or fittings. Maximum spacing between supports shall be as specified below. Actual spacing requirements will depend on structural system. Refer to drawings for additional requirements and attachment to structure. Vertical piping shall be supported at floor and ceiling. Support pipe within 12" of all changes in direction. Support individual pipes with pipe hanger. All pressure piping, drainage piping above grade and metallic piping of dissimilar metal from hangers shall have isolating shield, or felted hangers.

1) Screwed Pipe:

Pipe Size Between Supports*	Max. Spacing
(in)	(ft)
½	6
¾	8
1	8
1-1/4 & larger	10

* Based on straight lengths of pipe with couplings only. Provide additional supports for equipment, valves, or other fittings.

2) Copper Tubing: Copper tubing shall be supported at approximately six (6) foot intervals for piping one and one-half (1-1/2) inches and smaller in diameter and ten (10) foot intervals for piping two (2) inches and larger in diameter.

3) Gravity Drainpipe: Piping shall be supported at each length of pipe or fitting, but in no case at greater spacing than indicated above for pressure pipe.

b. Trapeze: Trapeze hangers of construction channel and pipe clamps may be used. Submit design to Engineer for approval.

5. Excavation and Backfill: Minimum cover on all piping shall be as follows unless otherwise noted:
   a. Up to 2-1/2" pipe - 24" cover.
   b. 3" and larger pipe - 30".
6. Miscellaneous:
   a. Escutcheons: Provide chromium plated escutcheons where piping penetrates walls, ceilings, or floors in finished areas.
   b. Pipe Sleeves: All piping passing through concrete shall be provided with pipe sleeves. Allow 1" clearance between sleeve and pipe or pipe insulation.
   c. Dielectric Couplings: Dielectric couplings shall be installed wherever piping of dissimilar metals are joined.
   d. Shock Absorbers: Install per manufacturers recommendations.

B. Sanitary Sewer Piping:
1. General: Where inverts are not indicated, sanitary sewer piping shall be installed at 1/4" per foot pitch. Piping 4" and larger may be installed at 1/8" per foot pitch where structural or other limitations prevent installation at a greater pitch.
2. Cleanouts: Install cleanouts at ends of lines, at changes of direction greater than 45 degrees, and at not greater than 100 foot intervals. Locate interior cleanouts in accessible locations and bring flush to finished surface. Cleanouts at urinals shall be installed above urinal.
3. Vents: Vents shall terminate not less than 6" above the roof nor less than 12" from any vertical surface nor within 10 feet of any outside air intake. Install horizontal vent lines at 1/4" per foot pitch. Offset vents 2 feet minimum from gutters, parapets, ridges, and roof flashing.

C. Water Piping: Connections to branches shall be made from the top side of the main. Supply header in fixture battery shall be full size to last fixture, reducing in size only on individual connections to each fixture in battery. Provide ball valve shutoff for each building and at each connection to equipment and trap primers. Shock absorbers shall be installed in a vertical position at end of branch runs as specified in this section whether specifically shown or not on drawings. Connections to equipment shall be made with flexible connectors. Non-metallic pipe shall have 18 AWG copper tracer wire laid on top of pipe and taped in place at 15-foot spacing, terminate 4" above grade at ends of pipe runs.

D. Gas Piping: Shall be pitched to drain to drip legs at each piece of equipment. No unions shall be installed except at connections to equipment. Provide shutoff at each equipment connection. Connections to equipment shall be made with flexible connectors. Under floor

piping shall be sleeved, sealed, and vented. Polyethylene or polyvinyl chloride pipe and fittings shall be joined in accordance with manufacturer's recommendation. Metal-to-plastic transition fittings shall be installed at all transitions. Non-metallic pipe shall have 18 AWG copper tracer wire laid on top of pipe and taped in place at 15-foot spacing, terminate 4" above grade at ends of pipe runs. All gas below grade shall have continuous caution tape installed 12” above gas line. All exposed gas piping shall be primed and painted, see painting section.

E. Condensate Drain Piping: Install with constant pitch to receptacle, 1/4" per foot where possible, otherwise 1/8" per foot minimum. Provide trap at each air handling unit to prevent air leakage. Connections to equipment shall be made with flexible connection unless connection is internally isolated.

F. Storm Drain Piping: Install at 1/4" per foot pitch.

G. Flue Piping: Flue piping shall be installed in accordance with its UL listing and manufacturer’s instructions.

3.2 PIPING INSULATION INSTALLATION

A. Domestic Tempered Water Supply:
1. General: All domestic tempered water supply piping, except for exposed connections to fixtures, shall be insulated. Do not insulate unions or valves less than 2", unless exposed to weather.
2. Install elastomeric pipe insulation by slipping over end of pipe. Where not feasible, slit insulation longitudinally, snap over piping and seal with adhesive. Insulate fittings with larger diameter sleeves or insulation, lapping pipe insulation a minimum of 2 in.
3. Butt sections of insulation tightly together and seal with adhesive to provide a continuous vapor and thermal barrier.
4. Pipe: Apply pre-molded fiberglass sections to pipe using integral pressure sealing lap adhesive in accordance with manufacturer's recommendations. Stagger longitudinal joints. Seal butt joints with factory supplied sealing tape.
5. Fittings and Valves:
   a. Wrap fitting with pre-cut fiberglass blanket to thickness matching adjoining insulation. Cover blanket with PVC jacket in accordance with manufacturer's recommendations. Seal all joints with factory supplied pressure sealing vapor barrier tape with 2" (min.) overlap on both sides of joint. Insulate valves to stem.
   b. For miscellaneous fittings for which PVC jackets are not available or where proximity of fittings precludes a neat-appearing installation, the contractor may cover the fiberglass blanket with stretchable glass fabric and at least two coats of vapor barrier coating. All exposed ends of insulation shall be adequately sealed.

B. ADA Compliant Fixtures:
1. At sinks/ lavatories which are to be ADA Compliant, the p-trap and angle stop assemblies shall be insulated with Trap Wrap Protective Kit 500R by Brocar, Truebro Handi Lav-Guard #102W or #105W or equal. Abrasion resistant exterior cover shall be smooth and have 1/8" wall minimum over cushioned foam insert. Fasteners shall remain substantially out of sight.

3.3 FIXTURE INSTALLATION

A. Fixture Height: Shall be standard height except those specified as ADA Compliant. Such fixtures shall be mounted in accordance with CBC, Section 11B, Division 6 and drawing details.

B. Wall Hung Fixtures: Shall be provided with proper backing and hanger plates secured to wall. Fixtures mounted on carriers shall bear against stop nuts, clear of wall surface. Caulk fixtures against walls with white G.E. “Sanitary SCS1700” silicone sealant. Caulking shall be smooth and flush with fixture surface (not concave).

C. Floor Drains or Floor Sinks: Shall be placed parallel to room surfaces, set level, flush with floor, and adjusted at proper height to drain and easily accessible for inspection and cleaning. Cover openings during construction to keep all foreign matter out of drain line.

D. Other Connections: Rough-in and connection for trim or fixtures supplied by others shall be included in this specification section.

E. Floor Mounted Fixtures: Shall be provided with proper support plates. Caulk fixtures against floors with white G.E. “Sanitary SCS1700” silicone sealant. Caulking shall be smooth and flush with fixture surface (not concave).

3.4 EQUIPMENT INSTALLATION

A. General: It shall be the responsibility of the equipment installer to ensure that no work done under other specification sections shall in any way block, or otherwise hinder the equipment.

B. Connections to Equipment: Where size reductions are required for connections to equipment, they shall be made immediately adjacent to the equipment and, if possible, inside the equipment cabinet.

3.5 TESTS AND ADJUSTMENTS

A. General: Unless otherwise directed, tests shall be witnessed by the Owner’s Representative. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test, and repair his work, and that of other contractors, to original conditions. Leaks and defects shown by tests shall be repaired and entire work retested. Tests may be made in sections. However, all connections between sections previously tested and new section shall be included in the new test. New sections shall be isolated from existing sections for testing purposes. There shall be no drop in pressure during test except that due to ambient temperature changes. All components of system not rated for test pressure shall be isolated from system before test is made. Test the new sections or branches of piping only.

B. Gravity System:
1. Sanitary Sewer: All ends of the new sections of sewer system shall be capped and lines filled with water to the top of the highest vent, 10 feet above grade minimum. This test shall be made before any fixtures are installed. Test shall be maintained until all joints have been inspected, but no less than 2 hours.
2. Condensate Piping: Maintain 15 psig water pressure for a duration of 4 hours.

C. Pressure Systems:
1. General: There shall be no drop in pressure during test except that due to ambient temperature changes. All components of system not rated for test pressure shall be isolated from system before test is made. Test the new sections or branches of piping only.
2. Domestic Tempered, Cold & DI Water Piping: Maintain 60 psig water pressure for a minimum duration of 2 hours.
3. Gas, Vacuum and Air Piping: Maintain 60 psig air pressure for a minimum duration of 2 hours.

D. Accessible Lavatories:
1. Faucet controls and operating mechanisms shall be installed and tested to comply per CBC Section 11B-606.4.

3.6 DISINFECTION

A. Disinfect all domestic hot and cold water piping systems in accordance with California Plumbing Code Sections 609.9.1 through 609.9.4. The method to be followed shall be that prescribed by the Health Authority or, in case no method is prescribed by it, the following:
1. The pipe system shall be flushed with clean, potable water until potable water appears at the points of outlet.
2. The system or parts thereof shall be filled with a water-chlorine solution containing not less than 50 parts per million of chlorine, and the system or part thereof shall be valved-off and allowed to stand for 24 hours; or the system or part thereof shall be filled with a water-chlorine solution containing not less than 200 parts per million of chlorine and allowed to stand for 3 hours.
3. Following the allowed standing time, the system shall be flushed with clean, potable water until the chlorine residual in the water coming from the system does not exceed the chlorine residual in the flushing water.
4. The procedure shall be repeated where it is shown by bacteriological examination made by an approved agency that contamination persists in the system.

B. Disinfection process shall be performed by certified testing agency or in cooperation with health department having jurisdiction and witnessed by a representative of the Architect. During procedure, signs shall be posted at each water outlet stating, "Chlorination - Do Not Drink". After disinfection, water samples shall be collected by certified testing agency or by health department for bacteriological analysis. Certificate of Bacteriological Purity shall be obtained and delivered to the Owner through the Owner’s Representative.

END OF SECTION 22 00 01

SECTION 23 00 00 - GENERAL MECHANICAL PROVISIONS

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PART 1 GENERAL

1.1 GENERAL CONDITIONS

A. The foregoing General and Special Conditions shall form a part of this Division with the same force and effect as though repeated herein. The provisions of this Section shall apply to all the Sections of Division 23.

1.2 CODES AND REGULATIONS

A. All work and materials shall be in full accordance with current rules and regulations of applicable codes and all California Amendments. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes. Should the drawings or specifications call for material or methods of construction of a higher quality or standard than required by these codes, the specifications shall govern. Applicable codes and regulations are:

1. California Code of Regulations – CCR:
   a. Title 8, Industrial Relations.
   b. Title 24, Building Standards.
2. California Building Code – CBC.
3. California Mechanical Code – CMC.
4. California Plumbing Code – CPC.
5. California Fire Code – CFC.
6. California Green Building Code.
7. Air Diffusion Council – ADC.
8. American Gas Association – AGA.
9. Air Moving and Conditioning Association – AMCA.
10. American National Standards Institute – ANSI.
11. Air Conditioning and Refrigeration Institute – ARI.
12. American Society of Heating, Refrigerating and Air Conditioning Engineers – ASHRAE.
13. American Society of Mechanical Engineers – ASME.
14. American Society for Testing and Materials – ASTM.
15. American Water Works Association – AWWA.
16. California Electrical Code – CEC.
17. National Electrical Manufacturers Association – NEMA.
18. National Fire Protection Association – NFPA.
19. Sheet Metal and Air Conditioning Contractors National Association – SMACNA.
20. Underwriters' Laboratory – UL.
21. Occupational Safety and Health Act - OSHA.

1.3 PERMITS AND FEES

A. The Contractor shall take out all permits and arrange for all tests in connection with his work as required by local ordinances. All charges are to be included in the work. Permits for equipment connected to a particular system are to be considered as a part of the work included under each system; for example, permits for electric motor connection are part of electrical work, permits for domestic water or gas connections are part of plumbing work. All charges for service connections, meters, etc. by utility companies or districts shall be included in the work.

1.4 COORDINATION OF WORK

A. Layout of materials, equipment and systems is generally diagrammatic unless specifically dimensioned. The actual locations of all materials, piping, ductwork, equipment, supports, etc. shall be carefully planned, prior to installation of any work, to avoid all interferences with each other, or with structural, electrical, or architectural elements. Verify the proper voltage and phase of all equipment with the electrical plans. All conflicts shall be called to the attention of the Engineer prior to the installation of any work or the ordering of any equipment.

1.5 GUARANTEE

A. Guarantee shall be in accordance with the General Conditions. These specifications may extend the period of the guarantee for certain items. Where such extensions are called for, or where items are normally provided with guarantee periods in excess of that called for in the General Conditions, the Certificate of Guarantee shall be furnished to the Owner through the Engineer.

1.6 EXAMINATION OF SITE

A. The Contractor shall examine the site, compare it with plans and specifications, and shall have satisfied himself as to the conditions under which the work is to be performed. No allowance shall subsequently be made in his behalf for any extra expense to which he may be put due to failure or neglect on his part to make such an examination.

1.7 SUBMITTALS

A. Submit shop drawings in accordance with Division 01.

B. Shop Drawings: Within 30 days of contract award, the Contractor shall submit six copies of shop drawings for all materials, equipment, etc. proposed for use on this project. Material and equipment shall not be ordered or installed until written review is processed by the Engineer. Any item omitted from the submittal shall be provided as specified without substitution. All shop drawings must comply with the following:

1. Shop drawings are required for all material and equipment items and shall include manufacturer's name and catalog numbers, dimensions, capacities, performance curves, and all other characteristics and accessories as listed in the specifications or on the drawings. Descriptive literature shall be current factory brochures and submittal sheets. Capacities shall be certified by the factory.
2. All shop drawings shall be submitted at one time in a neat and orderly fashion in a suitable binder with title sheet including Project, Engineer, and Contractor; Table of Contents; and indexed tabs dividing each group of materials or item of equipment. All items shall be marked with the specification paragraph number for which they are proposed. All equipment shall also be identified by the mark number as indicated on the drawings.
3. All capacities, characteristics, and accessories called for in the specifications or on the drawings shall be highlighted, circled, or underlined on the shop drawings. Calculations and other detailed data indicating how the item was selected shall be included for items that are not scheduled. Data must be complete enough to permit detailed comparison of every significant characteristic which is specified, scheduled, or detailed.

C. Substitutions: Manufacturers and model numbers listed in the specifications or on the drawings represent the standard of quality and the features desired. Unless otherwise noted, alternate manufacturers may be submitted for review by the Engineer. Calculations and other detailed data indicating how the item was selected shall be included. The Contractor shall assume full responsibility that substituted items or procedures will meet the specifications and job requirements and shall be responsible for the cost of redesign and

modifications to the work caused by these items.

D. Review: Submittals will be reviewed for general conformance with the design concept, but this review does not guarantee quantity shown, nor does it supersede the responsibility of the Contractor to provide all materials, equipment, and installation in accordance with the drawings and specifications. The Contractor shall agree that shop drawing submittals processed by the Engineer are not Change Orders; that the purpose of shop drawing submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept; that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. The Contractor shall agree that if deviations, discrepancies or conflicts between shop drawings and design drawings and specifications are discovered either prior to or after shop drawing submittals are processed by the Engineer, the design drawings and specifications shall control and shall be followed.

1.8 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Submit one electronic pdf copy for review and after approved submit three hard copies of the Operation and Maintenance Instructions and Wiring Diagrams for all equipment and parts lists for all equipment, etc. shall be submitted to the Engineer. All instructions shall be clearly identified by marking them with the same designation as the equipment item to which they apply (e.g. AC-1). All wiring diagrams shall agree with revised shop drawings and indicate the exact field installation. All instructions shall be submitted at the same time and shall be bound in a suitable binder with tabs dividing each type of equipment (e.g. Fans, Motors, etc.). Each binder shall be labeled indicating "Operating and Maintenance Instructions, Project Title, Contractor, Date" and shall have a Table of Contents listing all items included. **(These submittals shall be submitted with regular submittals at start of job so Commissioning Contractor can start on the commissioning check list for Title 24 Requirements)**

B. Verbal: The Contractor shall verbally instruct the Owner's maintenance staff in the operation and maintenance of all equipment and systems. The controls contractor shall present that portion of the instruction that applies to the control system. The Engineer's office shall be notified 96 hours prior to this meeting.

C. Posted: The Contractor shall prepare operation instructions for all systems which shall be typewritten, reviewed by the Engineer, and mounted under glass adjacent to the appropriate temperature control panel. These instructions shall include applicable temperature control diagrams.

D. Acknowledgment: The Contractor shall prepare a letter indicating that all operation and maintenance instructions (printed, verbal and posted) have been given to the Owner, to the Owner's satisfaction. This letter shall be acknowledged (signed) by the Owner and submitted to the Engineer.

1.9 RECORD DRAWINGS

A. The Contractor shall maintain a set of prints for the project as a record of all construction changes made. As the Work progresses, the Contractor shall maintain a record of all deviations in the Work from that indicated on the drawings. Final location of all underground work shall be recorded by depth from finished grade and by offset distance from permanent surface structures, i.e. buildings, curbs and walks. In addition, the water, gas, under-floor ducts, etc. within the building shall be recorded by offset distances from building walls. The original drawings will be made available to the Contractor from which he shall have a set of reproducible drawings made. The Contractor shall then transfer the changes, notations, etc. from the marked-up prints to the reproducible drawings. The record drawings (marked-up

prints and reproducibles) shall be submitted to the Engineer for review (as an alternative, the marked-up prints may be photocopied full size on reproducible stock).

PART 2 PRODUCTS

2.1 CONCRETE ANCHORS

A. Concrete Anchors shall comply with CBC 1901A.3. Steel stud with expansion anchor requiring a drilled hole; powder driven anchors are not acceptable. Minimum concrete embedment shall be 4-1/2 diameters. Minimum spacing shall be 10 diameters center-to-center and 5 diameters from center to edge of concrete. Maximum allowable stresses for tension and shear shall be 80% of the test report values "with special inspection". Anchors shall be Hilti, Philips - or Approved equal.

2.2 SEISMIC RESTRAINTS

A. All mechanical systems (all equipment, piping, etc.) shall be provided with seismic restraints in accordance with details on the drawings.

2.3 SYSTEM IDENTIFICATION

A. Above Grade Piping: Provide markers on piping which is either exposed or concealed in accessible spaces. For piping systems, other than drain and vent lines, indicate the fluid conveyed or its abbreviation, either by preprinted markers or stenciled marking, and include arrows to show the direction of flow. Comply with ANSI A13.1 for colors. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where lines pass through floor, walls or ceilings or otherwise pass into inaccessible spaces, and at 50' maximum intervals along exposed portion of lines. Marking of short branches and repetitive branches for equipment connections is not required.

B. Equipment: All equipment shall be identified with a plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-1). Provide 1/2" high lettering, white on black background. Nameplates shall be permanently secured to the unit.

C. Controls: Label all panels, thermostats and by-pass timers with plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-1). Provide 1/4" high lettering, white on black background. Nameplates shall be permanently secured to the unit.

2.4 EQUIPMENT SUPPORT FRAMES

A. Unless specifically noted otherwise, it shall be the responsibility of Mechanical Contractor to furnish and install all support frames for its equipment.

PART 3 EXECUTION

3.1 SCHEDULING OF WORK

A. All work shall be scheduled subject to the approval of the Engineer and Owner. No work shall interfere with the operation of the existing facilities on or adjacent to the site.

3.2 CONDUCT OF WORK

A. The Contractor shall have at all times, as conditions permit, a sufficient force of workmen and quantity of materials to install the work contracted for as rapidly as possible consistent with good work and shall cause no delay to other Divisions engaged upon this project or to the Owner.

B. Mechanical Contractor shall arrange for all cutting necessary for the proper installation of its work, providing all sleeves and chases necessary. Cutting shall not be done in such a manner to impair the strength of the structure. Any damage resulting from work shall be repaired by the Contractor at his expense to the satisfaction of the Engineer.

C. Progressively, daily at the completion of each day's work, and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.

D. **IAQ Management plan will be in effect for Cal Green Certification, including the sealing of duct ends before and during rough-in, specific requirements for the use of HVAC equipment during construction (if used at all), building flush-out, etc. Adhesives and mastic must comply with low VOC requirements and documentation (MSDS, etc.) shall be provided with submittals.**

3.3 OPENINGS, CUTTING AND PATCHING

A. The locations and dimensions for openings through walls, floors, ceilings, foundations, footings, etc. required to accomplish the work under this Specification Division shall be provided under this Division. The actual openings and the required cutting and patching shall be provided. Coring through existing concrete or masonry walls, floors, ceilings, foundations, footings, etc., and saw cutting of concrete floors or asphaltic concrete required to accomplish the work under this Specification Division shall be provided under this Division. Patching of these surfaces shall also be provided. Cutting and coring shall not impair the strength of the structure. Any damage resulting from this work shall be repaired at the Contractor's expense to the satisfaction of the Engineer.

3.4 MANUFACTURER'S RECOMMENDATIONS

A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of a particular item. The Contractor shall be responsible for all installations contrary to the manufacturer's recommendations. The Contractor shall make all necessary changes and revisions to achieve such compliance. Manufacturer's installation instructions shall be delivered to and maintained at the job site through the construction of the project.

3.5 QUIETNESS

A. Piping, ductwork, and equipment shall be arranged and supported so that vibration is a minimum and is not carried to the building structure or spaces.

3.6 DAMAGES BY LEAKS

A. The Contractor shall be responsible for damages to other work caused by leaks in the temporary or permanent piping systems prior to completion of work and during the period of the guarantee, and for damages to other work caused by disconnected pipes or fittings, and the overflow of equipment prior to completion of the work.

3.7 CLEANING

A. Progressively and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.

END OF SECTION 23 00 00

SECTION 23 00 01 - HEATING, VENTILATING AND AIR CONDITIONING

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PART 1 GENERAL

1.1 GENERAL CONDITIONS

A. The foregoing Section 23 00 00, General Mechanical Provisions shall form a part of this specification.

1.2 SCOPE

A. Included: Perform all work necessary and required to complete construction as indicated. Such work includes the furnishings of all labor, materials, and services necessary for a complete, lawful, and operating air conditioning, heating, ventilating system with all equipment as shown or noted on the drawings or as specified herein. The work includes, but is not necessarily limited to, the following:
1. Heating, ventilating and air conditioning equipment.
2. Air distribution system (Ductwork, Air Terminals, etc.).
3. System insulation.
4. Controls and control wiring and conduit for control wiring.

B. Work Specified Elsewhere:
1. Line voltage power wiring (60 volts or greater), motor starters in motor control centers, and disconnect switches are included in the electrical section.
2. Connection of gas and condensate drains to equipment.
3. Access doors.

PART 2 MATERIALS

2.1 DUCTWORK MATERIALS

A. General: All ductwork materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL-181 not exceeding a flame spread of 25 and smoke developed of 50. All ductwork shall be per Chapter 6 of the CMC.

B. Low Velocity Metal Ductwork: Metal ductwork shall be galvanized sheet steel, ASTM A653.

C. Low Velocity Flexible Ductwork: Insulated flexible ductwork. Continuous internal liner bonded to galvanized steel wire helix. One pound per cubic foot glass fiber insulation, R-8. Thermal conductivity shall not exceed 0.13 Btu/hr. sq. ft.- degrees F at a mean temperature of 75°F. Seamless vapor barrier jacket. Each length shall have a factory installed metal sleeve at each end. Duct shall be capable of continuous operation at 1.5" of water static pressure and 4000 ft./ min. air velocity. Maximum length 5 ft., single piece at runouts to air terminals. Genflex, Lamborn or equal.

D. Kitchen Hood Exhaust Duct: Ductwork shall be galvanized steel all welded construction, ASTM A240. United McGill Corp.

E. Dishwasher Hood Exhaust Duct: Ductwork shall be stainless steel all welded construction, ASTM A240. United McGill Corp or equal.

F. Spiral Duct: Ductwork shall be galvanized steel with uni-seal spiral seamlock and uni-seal fittings, ASTM A653. United McGill Corp or equal. All exposed spiral duct shall be painted,

color selected by Owner.

G. Bonding Adhesive: Durodyne WBG, Scotchgrip Adhesive 4230 or equal.

H. Duct Mastic: Minnesota Mining and Manufacturing Duct Sealer 800, Tuff-Bond No. 12, Glencoat Seal-Flex or equal.

I. Duct Joints:
1. As an option to joints and seams designated by SMACNA or shown on Drawings, the following systems may be used:
   a. Ducts with sides 24 inches to 48 inches, transverse duct joint system by Ductmate Jr., Nexus or equal (SMACNA "E" Type connection).
   b. Ducts 48 inches and larger, Ductmate Regular, Nexus (SMACNA "J" Type connection) or equal.

J. Fiber Tape: Mineral impregnated fiber tape and plastic activator-adhesive. Hardcast, Inc., United McGill Uni-Cast or equal.

K. Make-Up Air Duct: Ductwork shall be double wall insulated galvanized steel exterior and aluminum or stainless steel interior glass fiber insulation. 1.5 lb./cu. ft. density, 2" thick minimum, R-8. Thermal conductivity shall not exceed 0.13 Btu/ hr. sq. ft.-degrees F at a mean temperature of 75 degrees F. CSG Insulation Corp., Manville, Owens-Corning, Knauf or equal. Duct dimensions shown on drawings for double wall duct are clear (net) opening inside.

2.2 AIR TERMINALS AND DUCT FITTINGS

A. Grilles: (Grilles, Registers and Diffusers)
1. Information on Drawings: Refer to the Air Distribution Schedule on the drawings for the list of grilles. Manufacturer's model numbers are listed to complete the description. Equivalent models of J & J, Krueger, Barber-Colman, Anemostat, Price, Titus or equal. Refer to the floor plans for neck size, CFM, air diffusion pattern, and fire damper, if required.
2. Performance: If, according to the certified data of the manufacturer of the proposed units, the sizes indicated on the drawings will not perform satisfactorily, the units shall be re-selected by the Contractor for the proper diffusion, spread, drop, and throw.
3. Frame and Accessories: All supply, return, and exhaust grilles shall be provided with cushion heads and attachments to structure, unless otherwise noted. All surface mounted grilles shall have a perimeter gasket and flanged edge. All grilles shall have frames suitable for mounting in the surfaces designated by the architectural drawing, coordinate prior to ordering.
4. Finish: All ceilings and wall grilles shall have a paintable white finish unless otherwise noted. Interior components shall be flat black.
5. Gyms: Provide 12 Ga. wire safety cables for all overhead grilles in Gym.

B. Turning Vanes: Double wall, hollow metal, air-foil shape. Spacing in accordance with manufacturer's recommendations. Aero Dyne, HEP or equal.

C. Flexible Connection: UL listed neoprene coated 30-ounce fiberglass cloth. 3" metal, 6" fabric, 3" metal. Ventglas or equal.

D. Branch Duct Volume Damper: Volume control damper (VCD) in rectangular ducts shall be as follows: Opposed blade, 6” maximum blade width, 16-gage blade, 48” maximum length, nylon or oil impregnated bronze bearings, ½” diameter pin shaft, 16-gage channel frame, actuating rod and linkage out of air stream. VCD in round duct shall be as follows: Damper

blade full height of branch and 1" less than branch width. All branch dampers shall have regulator with stamped steel handle, spring loaded shaft nut, cast body, and serrated self-locking die cast core. Regulator for horizontal ducts overhead shall be mounted on sides or bottom of ducts. Secure a 12" length of brightly colored plastic ribbon to handle for ease of location. Where rectangular or round ductwork is insulated, slit insulation to allow handle to protrude. Ventlok 641 (with 607 end bearing for round ducts).

E. Fire/ Smoke Damper: Multi-blade construction in accordance with CBC & CMC. UL 555 and UL 555S labels. Blades shall have metal-to-metal seals and not rely on actuator torque to maintain leakage rating. Prefco, Air Balance, Ruskin, Greenheck 5020-1 with 5800MB2 power open/spring close operator, or equal.

F. Louvers: Refer to the Air Distribution Schedule on the drawings. Manufacturer's model numbers are listed to complete the description. Equivalent models of Ruskin, Greenheck, Dayton or approved equal. Contractor shall fabricate and provide 16 GA. galvanized perforated panel (50% Free Area) over exterior of all louvers and have field painted to match exterior wall. Refer to the floor plans for all sizes.

2.3 DUCTWORK INSULATION MATERIALS

A. General: All ductwork insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL-181 not exceeding a flame spread of 25 and smoke developed of 50.

B. Acoustic Lining: Glass fiber. One side coated to prevent fiber erosion up to 6000 ft./ min. Average noise reduction coefficient of 0.90. 0.13 Btu/ hr – sq. ft. – degrees F conductivity at a mean temperature of 75 degrees F, R-8. CSG Insulation Corp., Schuller, Owens-Corning, Knauf or equal. Duct dimensions shown on drawings for lined duct are clear (net) opening inside of lining.

C. Fiber Glass Blanket: Foil faced, 0.13 Btu/ hr – sq. ft. – degrees F conductivity at a mean temperature of 75 degrees F, R-8. CSG Insulation Corp., Schuller, Owens-Corning, Knauf or equal.

D. Bonding Adhesive: Benjamin Foster 85-15 or equal.

2.4 PIPING MATERIALS

A. Refrigerant Piping:
1. Type L hard temper seamless copper, ASTM B88. Wrought copper fittings ANSI B16.22. 50/ 50 lead-tin solder joints above grade, 95/ 5 tin-silver brazed joints below grade. Provide schedule 40 PVC sleeve pipe for all below grade refrigerant piping. All piping shall be sized per equipment manufacturer requirements.
2. Valves and Specialties:
   a. Line Valves: Bronze body, ball type, TFE locked in seals. Back seated valve stem. Contromatics C-11.
   b. Filter-Drier: Replaceable core. Capacity in accordance with ARI Standard 710. Sporlan "Catch-All".
   c. Moisture Indicator-Sight Glass: Double port. Henry, Sporlan.
   d. Vibration Isolating Connection: Seamless flexible bronze tubing, braid covered. Suitable for system pressure. American, Flexonics.

B. Miscellaneous Piping Items:
1. Pipe Support:
   a. Pipe Hanger: Adjustable split ring, swivel hanger and rod. Black malleable iron.

Size and maximum loads per manufacturer's recommendation. Felt Lined, Kin-Line 450 F.

b. Construction Channel: 12 gage 1-5/8" x 1-5/8" steel channel. Single or multiple sections. Self-locking nuts and fittings. Kin-Line, Unistrut.

2. Pipe Sleeves: 24 gage galvanized steel. Adjus-to-Crete #10 with #99 thimble for floors. #100 for walls.

C. Flashing: Flashing for piping through roof shall be prefabricated 24 gage galvanized steel roof jacks with 8" square flange around pipe. Seal with weatherproofing mastic.

2.5 PIPING INSULATION MATERIALS

A. General: All piping insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.

B. Refrigerant Piping: Rubber based elastomeric preformed pipe insulation. Thermal conductivity shall not exceed 0.25 Btu-in/hr-SF-degree F at mean temperature of 75 degrees F., 3/4" thick. Provide aluminum pipe and fitting jacketing. 0.016” thickness for straight pipe, 0.024” thickness for fittings with integral moisture barrier, pre-fabricated strapping and seals for piping exposed to weather, Childers, Pabco or equal.

1. Insulation shall be provided on both refrigerant lines for ductless split systems.

2.6 EQUIPMENT

A. General Requirements:

1. Capacity: Capacities shall be in accordance with schedules shown on drawings. Capacities are to be considered minimum.
2. Dimensions: Equipment must conform to space requirements and limitations as indicated on drawings and as required for operation and maintenance. Where Architectural screening is indicated, equipment shall not extend above or beyond screening. Equipment will not be accepted that does not readily conform to space conditions. Prepare and submit layout drawings for all proposed equipment (different than scheduled units) showing actual job conditions, required clearances for proper operation, maintenance, etc.
3. Ratings:
   a. Gas: Gas burning equipment shall be furnished with 100% safety gas shut-off, intermittent pilot ignition, and be CSA (US) certified, except that boilers shall be CSA (US) certified or UL listed.
   b. Electrical: Electrical equipment shall be in accordance with NEMA Standards and UL or ETL listed where applicable standards have been established.
4. Piping: Each item or assembly of items shall be furnished completely piped for connection to services. Control valves and devices shall be provided. Equipment requiring domestic water for non-potable use shall be provided with backflow preventer acceptable for intended use by local governing authorities.
5. Electrical:
   a. General: Each item or assembly of items shall be furnished completely wired to individual terminal blocks for connection to single branch electrical circuit. All electrical accessories and controls required by equipment shall be furnished. Provide terminal blocks for controls and interlocks not included in equipment package. Manual and magnetic starters shall have ambient compensating running overcurrent protection in all ungrounded conductors. Magnetic starters shall be manual reset, shall have H-O-A switches and auxiliary contacts. Controllers and other devices shall be in NEMA 1 or 3R enclosures as applicable.
   b. Wiring: Conductors, conduit, and wiring shall be in accordance with Electrical Specifications. Individual items within assembly shall be separately protected with

dead front, fused disconnect, fuse block, or circuit breaker for each ungrounded conductor, all accessible on operating side of equipment. Switches, contacts, and other devices shall be in ungrounded conductors.

c. Motors: Shall be rated, constructed, and applied in accordance with NEMA and ANSI Standards without using service factor. Single-phase motor shall be of type to suit application. Three-phase motors shall be open drip proof, NEMA B design on pumps and fans, NEMA C on reciprocating equipment, sealed ball bearing, three-phase induction unless otherwise noted. Design shall limit starting inrush current and running current to values shown on drawings. Motors 1 horsepower and larger shall be the premium efficiency type, tested according to IEEE Standard 112, Method B. Motors exposed to weather shall be TEFC. Motors in a fan air stream shall be TEFC or TEAO. Vertical motors outdoors shall be ODP or TEFC and shall have rain caps.

d. Starters: Motor starters shall be furnished for all equipment except where starter is in a motor control center as designated on the electrical drawings. Deliver starter to Electrical Contractor for installation and wiring.

e. Control Voltage: Equipment connected to greater than 240 volts shall be provided with 120 volt control circuit from integral protected transformer if separate source is not indicated on plans. 240 volt control is acceptable if confined within control panel.

f. Submittals: Included in shop drawings shall be internal wiring diagrams and manufacturer's recommend external wiring.

6. Fan Selection:
   a. Fan Curves: Performance curves shall be submitted for all units of 3000 CFM or greater. Operating point for forward curved fans shall be from point of maximum efficiency towards increased CFM limited by horsepower scheduled. Operating point for backward inclined fans shall be selected near point of maximum efficiency. Curves shall plot CFM verses static pressure with constant brake horsepower, RPM, and efficiency lines.
   b. Static Pressure: Unless otherwise noted, pressure scheduled as external static pressure (ESP) includes all ductwork and accessory losses external to the unit housing. Unless otherwise noted, pressure scheduled as total static pressure includes all ductwork, filter, coil, cabinet, damper, and other accessory losses. Unless otherwise noted, pressure scheduled as duct static pressure includes all supply and return ductwork and accessory losses external to the unit housing and plenum (as applicable). The allowance for filter losses is 0.3" WC, unless otherwise noted. Submit itemized static pressure losses for all components.
7. Filters:
   a. General: Tested and rated in accordance with ASHRAE Standard 52.2 and Title 24, C.C.R. Furnish and install one complete change of all filters after air balance in completed and prior to acceptance. Provide pressure differential gage across all filter banks.
   b. Filter Media: 2" media. MERV 13. Clean filter resistance 0.25" water at 500 fpm. Throw-away frame. Class 2. Camfil Farr AP.
   c. Pressure Differential Gage: Diaphragm actuated. 4" dial. Zero adjustment. Accuracy +/ - 2% of full scale. Range as required. Provide static pressure sensors, tubing, and mounting brackets. Dwyer Series 2000. Mark gage to indicate filter replacement pressure, coordinate point with filter and equipment manufacturers.
8. Mixing Dampers: Opposed blade, 16-gage. Six-inch maximum blade width, 48" maximum length. Nylon or oil impregnated bronze bearings. One-half inch diameter pin shaft. 16-gage channel frame. One percent maximum leakage at 4" WC in accordance with AMCA 500 for outside air dampers. Actuating rod out of air stream. Arrow.
9. Sound Ratings: Shall be in accordance with ASHRAE 36-72. Sound ratings shall not exceed scheduled values.
10. Drives: Unless noted as direct connected, drives shall be V-belt, rated at 150% of

motor horsepower. Multiple drive belts shall be matched set. Drive sheaves shall be dynamically balanced, adjustable, range +/ - 10%, selected at mid-range. Adjustable relative movement shall be lockable to shaft. Belts shall be aligned within 1-1/2 degrees at all times. Open drives shall be provided with OSHA approved open mesh belt guards. Belt guards exposed to weather shall be weatherproof enclosure with louvered face for adequate ventilation. Driving motor shall be mounted on adjustable rails. T.B. Woods, Browning. Submit RPM range of driven machine with drive selection.

B. Air Conditioning Unit (thru 20 tons):

1. General: Self-contained heating/cooling unit designed for outdoor installation. Factory assembled and tested. Provide all starters and relays required for operation. 24 volt control circuit from integral transformer. Weatherproof cabinet, galvanized steel with enamel finish. Drain pan. Multi-vane, centrifugal supply fan. ARI certified. Gas equipment AGA certified. BDP, Carrier, York, Trane, Lennox, and Daikin.
2. Refrigeration: Sealed Hermetic compressor with heater, high/ low pressure switch, recycling timer. Air-cooled condenser with propeller fan. Non-ferrous finned coil. Low ambient control to 45 degrees F, unless otherwise noted.
3. Heat: Gas fired. Aluminized or ceramic-coated welded steel heat exchanger. Electric ignition. Automatic gas valve, 100% safety shutoff.
4. Economizer with Power Exhaust: Economizer shall be a modulating power exhaust type where the unit will exhaust at the minimum outside air setpoint and exhaust 100% during economizer mode. Economizer with power exhaust is shipped separately and shall be field installed and wired under this section.
    a. Provide plastic air sampling tube to sense pressure in room for control of power exhaust. Tube shall be placed thru ceiling with escutcheon plate in room that unit serves.
    b. Modulating Economizer Sequence of Operation: The economizer system initially responds to a signal from the cooling thermostat and functions as a true first stage for cooling, while providing maximum fuel economy. The economizer is automatically locked out during the heating mode and holds the outdoor air damper at the minimum position settings. During the occupied period, the discharge sensor provides a signal to the actuator during free cooling or economizer mode. The signal opens the economizer damper until the discharge temperature drops below 50 degrees F. At this time, the signal causes the motor to drive the damper back to minimum position. As the discharge temperature climbs to 60 degrees F the motor will drive back open. During the occupied period, the actuator will not close past the minimum position. **(The setpoints maybe changed by Commissioning Contractor to optimize controls for LEED Certification or Title 24 Requirements.)** If the fully open actuator cannot satisfy the space demand, mechanical cooling is sequenced on. During the unoccupied period, the actuator will override minimum position setting and drive fully closed. On a loss of power, the actuator will spring return fully closed. When in heating operation, or when outdoor air temperature or enthalpy conditions are high, economizer operation is locked out, and actuator is held at minimum position. The staging relay is used when the first stage compressors must provide mechanical cooling when assisting the economizer. The staging relay can be omitted when the second stage compressors can be used to assist the economizer with mechanical cooling.
    c. CO2 Sensor Economizer Integration: When a CO2 sensor is used in conjunction with an economizer, the minimum position jumper between P and P1 on the logic is removed, and the sensor connected. When the CO2 sensor gets a reading higher than the setpoint, the sensor will signal the logic to modulate the o/a dampers open. The HVAC unit functions as if there is no economizer during the CO2 call for fresh air. When the CO2 level falls below the setpoint, the damper modulates back to the minimum position.
    d. Modulating Power Exhaust Sequence of Operation: When the outside air damper

on an economizer starts to open, extra air is introduced the system. As this happens, a mercury switch mounted on the economizer closes. This causes a switch to close on the variable speed controller, allowing high voltage power to be sent to an exhaust motor and blower. The mercury switch is adjusted to close at the 1% outside air damper position. The power exhaust is a centrifugal blower power exhaust. The power exhaust uses an adjustable transducer (0-10 VDC) to accurately compare the space pressure to atmospheric pressure and adjust the amount of exhaust air accordingly. The exhaust volume adjustment is accomplished using a variable frequency drive with a built-in PID control to maintain a field adjustable pressure set point.

5. Guarantee: Provide 5 year extended parts warranty on the condenser coil and compressor.

C. Ductless Split System Air Conditioning:
   1. Condensing Unit:
      a. General: Self-contained unit designated for outdoor installation. Factory assembled and tested. Provide all starters and relays required for operation. 24 volt control circuit from integral transformer. Weatherproof cabinet, galvanized steel with enamel finish. Drain pan. ARI certified. Provide 3/4" x 18 GA. expanded metal coil guards. Daikin, Quietside, Carrier, York, Trane, and Mitsubishi.
      b. Refrigeration: Sealed Hermetic compressor with internal vibration isolating mount. Crank case heater, high/low pressure switch, anti-recycle timer. Air-cooled condenser with propeller fan. Non-ferrous finned coil. Low ambient control to 25°F, unless otherwise noted.
      c. Guarantee: Provide 5 year extended warranty on the condenser coil and compressor.
   2. Indoor Unit: Multi-speed direct drive blower on vibration mountings, filters, capacity as scheduled on plans. Daikin, Quietside, Carrier, York, Trane, and Mitsubishi.
   3. Coil Section: Encased coil. Casing shall be galvanized steel finished with baked enamel. Direct expansion evaporation coils complete with distribution piping, expansion valve, drain pan, and drain connection. Daikin, Quietside, Carrier, York, Trane, and Mitsubishi.

D. Exhaust Fans:
   1. General: All exhaust fans shall be tested and rated in accordance with AMCA Standard 210. Fans exposed to the weather shall have ventilated weatherproof housing over motor and drive assembly.
   2. Ceiling Fan: Ceiling mounted direct drive centrifugal exhaust fan with exhaust grille. Motor mounted on rubber-in-shear isolators. Motor and fan removable through grille. Acoustically lined housing. Backdraft damper. UL listed. Penn, Cook, ACME, Greenheck or equal.
   3. Kitchen Hood Fan: Multi-vane centrifugal fan. Ball bearings. Vibration isolation mount. All aluminum construction with steel or aluminum wheel, and aluminum curb base. Weatherproof disconnect switch. Upblast type UL listed for removal of smoke and grease laden vapors (YZHW, 762), for kitchen hood service. Cook, Greenheck, Penn, ACME or equal.
   4. Roof Fan: Multi-vane centrifugal fan. Ball bearings. Vibration isolation mount. All aluminum curb base. Weatherproof disconnect switch. Up blast type UL listed. Cook, Greenheck, Penn, ACME or equal.

E. Make-Up Air Unit (Direct):
   1. General: Greenheck or equal shall be furnished per schedule. Equipment shall consist of a furnace section (fueled by natural gas), blower, and direct evaporative cooling section. The unit shall be tested as a complete package prior to shipment.
   2. Furnace and Controls: Indirect fired gas furnace shall be 80% efficient, ETL list and

certified to ANSI Z83-8. The furnace shall have a blow through fan design. Furnace shall be capable of operation with natural gas and have a power venting system. The burner and heat exchanger shall be constructed of stainless steel. Standard furnace features shall include main gas pressure regulator, main gas valve, electronic staged or electronic modulating controls, electronic intermittent pilot ignition system, high limit and a 24 volt control transformer.

3. Unit Casing and Frames: Unit shall be of double wall construction. Internal frame type construction of galvanized steel. All frames and panels shall be G90 galvanized steel. Where top panels are joined there shall be a standing seam to insure positive weather protection. All metal-to-metal surfaces exposed to the weather shall be sealed, requiring no caulking at job site. All components shall be easily accessible through removable doors. Insulation in accordance with NFPA 90A and tested to meet UL 181 erosion requirements and secured to unit with waterproof adhesive and permanent mechanical fasteners. Permatector exterior finish, color by Architect. Unit base to be designed for curb mounting, curb to be furnished with the unit. Unit base shall overhang the curb for a positive seal against water run-off.
4. Fan Section: Centrifugal fans shall be double width, double inlet. Fan and motor shall be mounted on a common base and shall be internally spring isolated. All blower wheels shall be statically and dynamically balanced. Ground and polished steel fan shafts shall be mounted in permanently lubricated ball bearings or ball bearing pillow blocks. Bearings shall be selected for a minimum (L10) life in excess of 100,000 hours at maximum cataloged speeds.
5. Motors and Drives: Motors shall be energy efficient, complying with EPACT standards, for single speed ODP and TE enclosures. Motors shall be permanently lubricated, heavy-duty type, matched to the fan load and furnished at the specified voltage, phase and enclosure. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be cast and have machined surfaces, 10-horsepower and less shall be supplied with an adjustable drive pulley.
6. Electrical: All internal electrical components shall be prewired for single point power connection. All electrical components shall be UL listed, recognized, or classified where applicable and wired in compliance with the National Electrical Code. Control center shall include motor starter, control circuit fusing, control transformer for 120 VAC circuit, integral door interlocking disconnect switch with separate motor fusing and terminal strip. Contactors Class 20 adjustable overload protection and single-phase protection shall be standard.
7. Filter Section: Filters shall be mounted in a V-bank arrangement such that velocities across the filters do not exceed 550.0 ft./ min. Filters shall be easily accessible through a removable access panel.
8. Direct Evaporative Cooling Section: Evaporative Cooling media shall be Munters CELdek with a depth of 12 inches for a cooling effectiveness of 90%, with a stainless steel housing all provided by the Heat Recovery Unit manufacturer. Drain and overflow connections with bleed kit shall be piped through the side of the HRE unit.
9. Weather Hood: Weather hoods shall be the same finish as the unit and shall be constructed of G90 galvanized steel with bird screen mounted at the intake.
10. Control Panel: Provide remote control panel with On-Off-Vent-Cool-Heat indicator lights and programmable thermostat control on face of panel. Permatector coated galvanized control panel.

PART 3 EXECUTION

3.1 DUCTWORK INSTALLATION

A. General:

1. Standards: Unless otherwise noted, all ductwork shall be constructed and installed in accordance with current SMACNA "HVAC Duct Construction Standards". Ductwork

and accessories shall be installed in a manner to prevent vibration and rattling.

2. Seismic bracing: All ducts shall be braced and supported per details on the drawings.
3. Duct Access Doors: Provide access doors as required to adjust equipment and dampers.
4. Flexible Connections: Connections of ductwork to all equipment shall be with 6" (min.) flexible connection. Install with ample slack and uniform gap after deflection of vibration isolators. There shall be no metal to metal contact across flexible connection. Protect outdoor connections with weatherproof metal shroud on top and sides, no metal-to-metal contact. Provide at all seismic joints.
5. Ducted Returns: All air handling that is not directly located in the space that it serves shall have ducted returns.
6. Open ends of ductwork shall be covered during construction to keep inside clean.

B. Low Velocity-Low Pressure (up to 2000 ft/ min; up to 2.0 in. water):

1. Sheet Metal Ductwork:
   a. Ells: Ells with less than standard radius and square ells shall be fitted with turning vanes.
   b. Tees: Tees shall be straight tap-in with extractor or 45 degree takeoff, as shown on drawings.
   c. Duct Joints: Seal duct joints airtight with fiber tape and adhesive per manufacturer's printed instruction. Ducts in weather shall be sealed air and watertight with duct mastic before closing and taping.
      1) Where Ductmate type joints are used, the manufacturer's designated procedure shall be followed. Ductmate joints on roof shall have continuous cleat on top duct flange to prevent water from collecting on gasket.
   d. Dampers: Install volume control damper and damper regulator in all branch ducts.
   e. Duct dimensions shown on drawings for lined ducts, are clear net openings inside of lining.
   f. Top of ducts exposed to weather shall be cross broken and sloped slightly to each side to allow rainwater to run off. Ducts that do not drain off top will be rejected and need to be replaced at contractors' expense.
2. Flexible Glass Fiber Ductwork: Hangers shall be 2" wide metal straps spaced to prevent sagging, 3 feet spacing maximum. Insert 6" wide fiberglass pad between duct and hanging strap. All joints and fittings shall be sheet metal and shall be installed with metal bands or 3 (min) self-tapping screws and fiber tape. Maximum length of flexible duct shall be 5 ft. Single piece minimum length shall be 3 ft. Minimum turn radius shall be in accordance with SMACNA Standards (turn radius to duct centerline not less than 1.5 times the duct diameter).

3.2 AIR TERMINALS AND DUCT FITTINGS INSTALLATION

A. General: Unless otherwise noted, all air terminals and duct fittings shall be installed in accordance with current SMACNA "HVAC Duct Construction Standards", details on drawings and manufacturer's instructions. Terminals and fittings shall be installed in a manner to prevent vibration and rattling.

B. Fire Smoke Damper: Fire smoke dampers shall be installed in accordance with their State Fire Marshal approval and the manufacturer's recommendations.

C. Gym: Attach safety cable to inside of duct and to grille neck with #10 sheet metal screws.

3.3 DUCTWORK INSULATION INSTALLATION

A. General: All supply and return sheet metal ductwork shall be insulated.

B. Concealed Ductwork: Wrap ductwork with fiberglass blanket lapped 2" minimum. Secure

with foil tape at all joints for a complete vapor barrier.

C. Acoustic Lining: All ductwork in equipment rooms, where exposed to weather, and elsewhere as indicated on drawings, shall have acoustic lining. Increase each sheet metal dimension to accommodate lining and maintain clear inside duct dimensions shown on drawings. Apply lining with bonding adhesive in accordance with manufacturer's recommendations and secure with mechanical fasteners in accordance with SMACNA Standards. Seal exposed edges of lining with bonding adhesive.

3.4 PIPING INSTALLATION

A. General:
1. Piping Layout: Piping shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed piping shall run parallel to room surfaces; location to be approved by Architect. No structural member shall be weakened by cutting, notching, boring or otherwise unless specifically allowed by structural drawings and/ or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed. All piping shall be installed in a manner to ensure unrestricted flow, eliminate air pockets, prevent any unusual noise, and permit complete drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment. Expansion joints and/or flexible connectors shall be installed as required. Vertical lines shall be installed to allow for building settlement without damage to piping. Lines shall be adequately braced against vertical and lateral movement.
2. Pipe Support:
a. General: Hangers shall be placed to support piping without strain on joints or fittings. Maximum spacing between supports shall be as specified below. Actual spacing requirements will depend on structural system. Refer to drawings for additional requirements and attachment to structure. Vertical piping shall be supported at floor and ceiling. Support pipe within 12" of all changes in direction. No perforated straphanger shall be used in any work.
b. Refrigerant Piping: Pipe shall be cut square. Joint surfaces shall be thoroughly cleaned, fitted, and erected before brazing. Install specified accessories. After installation, evacuate to 29 inches of mercury, ambient temperature during evacuation shall not be less than 70 degrees F. After evacuation, fill with dry nitrogen to 250 psi and maintain for two-hour period without additional charge. After nitrogen test, purge with refrigerant charged through dryer and maintain holding charge in system and equipment. Refrigerant piping below grade shall be run in 4” (min.) PVC conduit with long radius ells. Seal ends of conduit watertight.

3.5 PIPING INSULATION INSTALLATION

A. Refrigerant Piping: Cover suction piping with foamed plastic insulation. Longitudinal and end seams shall be thoroughly cemented with adhesive in accordance with manufacturer's recommendation. Cover all fittings, unions, valves, and connections. Piping exposed to weather shall be covered with aluminum jacketing, seal all joints and seams with grey outdoor mastic or silver silicone sealant. Piping exposed in room shall be covered with piping chase painted to match wall.

3.6 EQUIPMENT INSTALLATION

A. General: It shall be the responsibility of the contractor to ensure that no work done under other specification sections shall in any way block, or otherwise hinder access panels or diminish the effectiveness of equipment vibration isolation.

B. Connections to Equipment: Where size reductions are required for connections to

equipment, they shall be made immediately adjacent to the equipment and, if possible, inside the equipment cabinet. Connections made to equipment mounted on vibration isolators shall be with flexible connectors, installed adjacent to equipment.

C. Start Up: Engage manufacturer or factory-authorized service representative to perform start up supervision. Manufacturer shall provide on-site start up and commissioning assistance through job completion. Complete installation and start up checks according to manufacturer's written instructions.

3.7 TEMPERATURE CONTROL SYSTEM

A. Thermostats shall have the capability of terminating all heating at a temperature of no more than 70 degrees F or terminating all cooling at a temperature of no less than 78 degrees F, and to provide a temperature range of up to 10 degrees F between full heating and full cooling. Thermostats shall be 7 day programmable, Wifi enabled with sub-base capable of battery backup or capacitor to retain program in the event of a power outage. All control wiring, regardless of voltage, shall be installed in conduit. Provide Venstar model T8900 per District Standard.

3.8 SYSTEM AIR BALANCE

A. Scope: Provide the services of a qualified independent test and balance agency certified by the Associated Air Balance Council (AABC) or The National Environmental Balancing Bureau (NEBB) to test, adjust and balance, retest, and record performance of the system to obtain design quantities as specified. Balancing contractor must also be TABB certified and have a C-20 license.

B. Qualifications: Prior to commencing work, the agency shall be approved by the Owner's Representative.

C. Instruments: All instruments shall be accurately calibrated; calibration histories shall be available for examination. Application of instrumentation shall be in accordance with AABC standards.

D. Procedure: General: Balanced quantities shall be plus 5%, minus 5% of design quantities. All name-plate data, manufacturer, model, and serial numbers shall be recorded for each item tested.

E. Extended Warranty: The test and balance agency shall include an extended warranty of 90 days after completion of test and balance work, during which time the Owner's Representative at his discretion may request a recheck or resetting of any item or items in test report. The agency shall provide technicians to assist the Owner's Representative in making any tests he may require during this period of time.

F. Air Balance Procedure (for each Air Handling System):
1. All air filters shall be clean when air balance is performed.
2. Provide a sketch of the equipment showing exactly where all pressure readings were taken.
3. Adjust blower RPM to design requirements.
4. Record motor full load amperes.
5. Make pitot tube traverse of main supply and return ducts and obtain design CFM at fans.
6. Record system static pressures, inlet, and discharge.
7. Record filter quantity, size(s) and pressure drop across filter(s) at each filter bank.
8. Adjust system for design CFM recirculated air.

9. Adjust system for design CFM outside air.
10. Record entering air temperatures. (DB heating, DB and WB cooling.)
11. Record leaving air temperatures. (DB heating, DB and WB cooling.)
12. Adjust all main supply and return air ducts to design CFM.
13. Adjust all zones to design CFM, supply, and return.
14. Adjust all diffusers, grilles, and registers to plus 10%, minus 0% of design requirements.
15. Adjust CFM at all exhaust fans, make-up units, etc. (high and low speed, where applicable). Record applicable data from items 1 through 11 above.
16. Each grille, diffuser and register shall be identified as to location.
17. Verify proper diffusion pattern for all ceiling grilles and that all sidewall grilles are set for 5 degrees downward deflection unless otherwise noted. Make a notation of any that are not set properly.
18. Size, type and manufacturer of diffusers, grilles, registers, and all tested items shall be identified and listed. Manufacturer's ratings shall be used to make required calculations on all items.
19. Readings and tests of diffusers, grilles, and registers shall include required FPM velocity and test resultant velocity, required CFM and test resultant CFM after adjustments.
20. In cooperation with the control manufacturer's representative, set adjustments of automatically operated dampers to operate as specified. Testing agency shall check all controls for proper calibrations and list all controls requiring adjustment by control installers.
21. All diffusers, grilles and registers shall be adjusted for required air patterns and to minimize drafts.
22. As a part of the work of this contract, THE AIR CONDITIONING CONTRACTOR shall make any changes in pulleys, belts, dampers, or the addition of dampers cleaning of insect screens and replacement of filters required for correct balance as recommended by air balance agency, at no additional cost to Owner.
23. Set, test, and adjust packaged heating/ cooling unit economizer operation in cooperation with controls contractor. Record minimum and maximum outside and exhaust airflows.

G. Test, adjust, and retest water bleed rates from evaporative coolers. Record all data.

END OF SECTION 23 00 01

5

SECTION 28 16 00

INTRUSION DETECTION

AD 5-09a
S&B Elemenatary
02-116800

PART 1: GENERAL

1.1 RELATED SECTIONS

A. Section 26 05 00 – Common Work Results for Electrical

B. Section 27 20 00 – Structured Cabling

C. Section 28 00 00 – Electronic Safety and Security

1.2 REFERENCES

A. The system shall be listed as a Power Limited Device and be listed under the standards in this section. Each system shall be supplied with complete details on all installation criteria necessary to meet all of the listings.

B. Underwriters Laboratories (UL):
1. UL 365 Police Connect Burglar
2. UL 609 Local Burglar
3. UL 1023 Household Burglar Alarm System Units
4. UL 1076 Proprietary Burglar
5. UL 1610 Central Station Burglar Alarm Units
6. UL 1635 Digital Burglar Alarm Communicator System Units
7. UL 864 Control Units for Fire Protective Signaling Systems
8. UL 985 Household Fire Warning
9. UL 294 Access Control System Units

C. California Code of Regulations
1. Title 24, Part 3 – California Electrical Code

D. National Fire Protection Association (NFPA)
1. NFPA 70 National Electric Code (NEC)
2. NFPA 72 Local Protective Signaling
3. NFPA 72 Remote Station Protective Signaling
4. NFPA 72 Proprietary Protective Signaling
5. NFPA 72 Household Fire Warning

E. U.S. Government Standards / Listings
1. DCID 6/9
2. DoD/NIST SCIF Standards

1.3 SCOPE OF WORK

A. Furnish and install a complete Intrusion Detection / Access Control system with the performance criteria detailed in this specification.

B. This specification document provides the requirements for the installation, programming, and configuration of a complete Command Processor Panel. This system shall include, but not be limited to:
   1. Control panel
   2. System cabinet
   3. Power supply
   4. Keypad bus
   5. Batteries
   6. Wiring
   7. Conduit
   8. Associated peripheral devices

1.4 SYSTEM DESCRIPTION

A. General:
   1. The system areas and zones shall be programmable, and the system shall store, log, display, and transmit specific custom designations for system areas, zones, and user names.
   2. To ensure continued, one-call support, the system shall be constructed of sensing components provided directly by the system manufacturer, such as power supplies, motion detectors, door and window position switches, glass break detectors, or other sensing devices that the manufacturer offers.
   3. The system controller, user interfaces, zone input devices, relay output devices, and the system signal receiving equipment shall be engineered, manufactured, assembled, and must be distributed from a location within the United States of America.
   4. The system shall support user interaction by way of a keypad, web browser, system software, key switch, or radio frequency wireless control, using integrated or auxiliary devices provided by the system manufacturer.
   5. The system shall support controller zone input connections, system keypads, system zone expansion modules, and wireless zone input modules, and must support zone input connections by way of at least two competitive products. The system shall offer a seamless integrated compatibility with hard-wire and/ or wireless zone expansion equipment for at least 200 wireless zones and/ or a maximum of 574 hardwired zones.
   6. The system shall be capable of offering at least five zone expansion buses, each of which can support the connection of up to 15,000 feet of four-wire cable. Zone expansion and keypad data buses that exceed 2,500 feet of cable must include splitter/repeater modules to boost data voltage and maintain data integrity.
   7. The system shall provide a seamless capability to provide a minimum of 500 addressable relays, which can be located at any connection location upon a zone expansion bus.
   8. System relay outputs shall have the capability of being triggered as a result of a command from the user interface, changes in system status, changes in zone status, or by a programmable schedule.
   9. System relay output states shall be programmable for momentary, maintained, pulsed, or must follow the state of an associated system zone input.

10. The system shall be completely programmable either locally from a keypad or remotely through a standard dial-up, and network connections by way of a LAN, WAN, and/or by way of the Internet.
11. The control unit shall be completely programmable remotely using remote annunciators, and/ or using upload/ download software that communicates using SDLC 300 baud, 2400 baud, or IP Addressed data network. On-site programming from a personal computer shall also be permitted.
12. The control unit shall be equipped with an anti-reversing circuit breaker to prevent damage due to accidental reversal of battery leads.
13. The master control unit shall be connected to expansion modules via fiber optic cables and transceivers on the data network. There will be no separate copper cable runs across the site for the intrusion system.

B. Input/Output Capacity:
1. This system shall be capable of monitoring a maximum of 574 individual zones and controlling a maximum of 502 output relays.
2. The control panel shall have, as an integral part of the assembly, 2 SPDT Form C relays rated at 1 Amp at 30 VDC and four open collector 12 VDC outputs rated at 50mA each. It shall also have the capacity of a maximum of 125 output expander modules with 500 switched ground, open collector outputs, 50mA maximum and 502 auxiliary relays (Form C rated at 1.0 Amp at 30 VDC).
3. The panel shall also provide 100 programmable output schedules, and include an integral bell alarm circuit providing at least 1.5 Amps of steady, pulsed, or temporal bell output. Output type shall be programmable by zone type. Relays and voltage outputs shall be capable of being independently programmed to turn on and/or off at selected times each day.

C. User/Authorization Level Capacity:
1. The system shall be capable of operation by 10,000 unique Personal Identification Number (PIN) codes with each code having one (1) of ninety-nine (99) custom user profiles. This allows for limitation of certain functions to authorized users. The operation of all keypads shall be limited to authorized users.

E. Zone Configuration:
1. A minimum of 4 Class B ungrounded zones shall be available at each keypad or zone expander on the system. The system shall have the capacity for a maximum of sixteen (16) keypads and a maximum of 125 four (4) zone expanders or 500 single zone expanders. It shall also have the capacity of a maximum of 125 supervised relay output expanders. All Class B zones shall be 2-wire, 22 AWG minimum, supervised by an end-of-line (EOL) device and shall be able to detect open and short conditions in excess of 500ms duration.
2. Each zone shall function in any of the following configurations: Night, Day, Exit, Fire, Supervisory, Emergency, Panic, Auxiliary 1, Auxiliary 2, Fire Verification, Cross Zone, Priority, and Key Switch Arming.
3. The keypad bus shall be able to operate at a maximum wiring distance of 2500 feet from the control panel on unshielded, non-twisted cable. This

distance may be extended to a total of 15,000 feet when bus repeater modules are installed.

4. The system shall have the capability to incorporate up to 200 zone expander POPIT™ points.
5. Each zone shall function in any of the following configurations:

Night	Supervisory	Auxiliary 1	Cross-Zone
Day	Emergency	Auxiliary 2	Priority
Exit	Panic	Fire Verification	Arming
Fire			

F. Communication:
1. The system shall be capable of signaling to as many as 8 remote monitoring station receivers. Seven (7) of the eight (8) paths shall be capable of being assigned as either a “primary” or “backup” path. In such a manor the system shall have multiple primary paths to multiple remote monitoring stations as well as multiple backup paths to multiple monitoring stations.
2. The system shall be capable of signaling to two remote monitoring station receivers, four telephone numbers of 32 digits each using two separate switched telephone network lines such that if two unsuccessful attempts are made on the first line to the first number, the system shall make two attempts on first line to the second number. If these two attempts are unsuccessful, the system shall make two further attempts on the first line of the first number. After the tenth unsuccessful attempt, dialing shall stop and the alphanumeric keypad shall display trouble. Should another event occur that requires a report to be transmitted, the dialing sequence shall be repeated. The system shall have a programmable option to dial a second set of telephone numbers after the first ten attempts using the same sequence.
3. The system shall be capable of communication using the IBM Synchronous Data Link Control format, and at least two other standard industry formats.
4. The system shall be capable of supporting Network communication with digital dialer backup, existing Ethernet data networks, satellite communication, fiber optic networks, local area networks, wide area networks, cellular communication, and retail data networks.

G. Network Communication:
1. The control panel shall be capable of asynchronous network communication with a retry time between 3 and 15 seconds for a total of one (1) minute. If communication is unsuccessful the control panel shall be capable of attempting backup communication through any of the available communication methods to the same receiver or a backup receiver.
2. The control panel shall employee adaptive communication technology. Adaptive Technology allows a Backup communication path programmed to use Network or Cellular to automatically ADAPT to the faster check-in rate of the Primary path should the Primary path become unavailable, creating a seamless transition for communication of messages. Select Adapt when programming the Checkin option. This allows a system to be

fully supervised even if a path fails, while also keeping wireless charges low when the network is good.

3. Network communication between the control panel and the receiver shall be in a proprietary communication format.
4. The control panel shall be capable of supporting Dynamic Host Communication Protocol (DHCP) Internet Protocol (IP) addressing.
5. Underwriters Laboratories (UL) shall list network communication by the control panel for Grade AA High-Line Security.
6. The control panel shall be capable of two-way network communication using standard Ethernet 10BaseT in a LAN, WAN, or Internet configuration.
7. The control panel shall be capable of communication by means of a 128 Bit AES Rijndael Encryption process certified by NIST (National Institute of Standards and Technology) to an SCS-1R receiver with a built-in Encryption Alarm Router.
8. The control panel shall be capable of meeting DCID 6/9 and UL 2050 standards.

H. TCP/IP Network Trapping:

1. The control panel shall be capable of having communication set to Network operation. When a trap is set in Remote Link, the software shall be capable of sending a panel trap message with the panel account number to the SCS-101 installed in an SCS-1R receiver.
2. The receiver SCS-101 shall store the trap and monitor the panel for the next message. When the panel sends its next message, the receiver SCS-101 shall then send a message to the panel to contact Remote Link at the IP address contained in the original trap message.
3. The trap message shall be stored in the receiver SCS-101 for up to four hours. If the trap message is not sent to the panel within the four-hour window, the panel trap message shall be discarded and a new trap message must be sent from Remote Link.
4. The user shall be able to view the trap status in the receiver SCS-101 in Remote Link using the Trap Query function.

1.5 SUBMITTALS

A. Provide the following items in addition to the basic submittal requirements of Section 28 00 00.

1. Licensure
2. Submit proof of possession of a valid California Alarm Company Operator's License in good standing with the California Bureau of Security and Investigative Services.

PART 2: PRODUCTS

2.1 MANUFACTURER

A. Digital Monitoring Products, Incorporated (DMP)
2500 N. Partnership Boulevard, Springfield, MO 65803
Phone (417) 831-9362. FAX (417) 831-1325. Website: www.dmp.com

B. The manufacturer shall have at least twenty-five (25) years of experience in the role of fire and security control manufacturing, and a proven track record of forward and backward compatibility for a minimum of twenty (20) years for its product's auxiliary devices, including system keypads, annunciation devices, zone expansion modules, and addressable detection devices.

C. The manufacturer must also manufacture receiving equipment that is compatible with standard dial-up telephone lines and network monitoring equipment that is compatible with a LAN, WAN, and the Internet. The receiving equipment shall be capable of receiving all status and alarm messages generated by the system. The receiving equipment shall be capable of updating the panel operating program and the system date and time.

2.2 CONTROL PANEL

A. DMP Command Processor™ Panel
1. The system shall be inclusive of all necessary function, monitoring, and control capability as detailed herein and on accompanying shop drawings.

2.3 GENERAL COMPONENT REQUIREMENTS

A. Component Enclosure
1. Housings; power supply enclosures, terminal cabinets, control units, and other component housings, collectively referred to as enclosures shall be so formed and assembled as to be sturdy and rigid. If sheet steel is used in the fabrication of enclosures, it shall be not less than an 18 gauge door with a 20 gauge box frame. Where exposed pins, the hinges shall be of the tight pin type or the ends of hinge pins shall be tack welded to prevent ready removal. Doors having a latch edge length of less than 24 inches shall be provided with a single lock. Where the hinged door latch edge is 24 inches or more in length, doors shall be provided with three-point latching device with lock; or alternatively with two locks, one located near each end. For SCIF and High Security applications an attack proof enclosure with proper tampers UL listed for use with the XR500/XR500N/XR500E shall be used.

B. Electronic Components
1. All system electronic components shall be solid-state type, mounted on printed circuit boards. Light duty relays and similar switching devices shall be solid-state type or electromechanical.
2. The panel shall have an over current notification LED that lights when devices connected to the Keypad Bus and LX-Bus(es) draw more current than the panel is rated for. When the over current LED lights, the LX-Bus (es) and Keypad bus are shut down.

C. Control Unit
1. A battery test shall be automatically performed to test the integrity of the standby battery. The test shall disconnect the standby battery from the charging circuit and place a load on the battery. This test shall be performed no more than every 180 seconds.

2. The control unit shall be capable of operating and supervising notification appliance devices as well as addressable initiating detection devices and an integrated supervised dual line digital communicator.
3. Control unit must be “Flash ROM” updatable, and program must be held in non-volatile RAM. The panel shall be able to function while the update is in process.
4. Control unit shall be capable of operating using an optional built in Encrypted Alarm Router for SCIF (Sensitive Compartmented Information Facility) applications that is certified by NIST (National Institute of Standards and Technology) for 128 Bit AES Rijndael Encryption communications.
5. The optional built-in Encrypted Alarm Router shall be capable of compliance with DCID 6/9 and UL 2050 standards.

D. Remote Annunciators
1. The system shall support a maximum of sixteen (16) supervised remote annunciators with the identical capabilities, functions and display layout. Operation of the remote annunciators shall be limited to authorized users by the use of a code or key.
2. The remote annunciators shall be capable of operating at a maximum wiring distance of 15,000 feet from the control unit on unshielded, non-twisted cable.

E. Control Designations
1. Controls shall be provided to ensure ease of operation of all specified characteristics. Where applicable, clockwise rotation of controls shall result in an increasing function. Controls, switches, visual signals and indicating devices, input and output connectors, terminals and test points shall be clearly marked or labeled on the hardware to permit quick identification of intended use and location.

F. Test Modes
1. The system shall include a provision that permits testing from any alphanumeric keypad. The test shall include standby battery, alarm bell or siren, and communication to the central station.
2. The system shall include a provision for an automatic, daily, weekly, thirty (30) day, or up to sixty (60) day communication link test from the control panel installation site to the central station.
3. The system shall include a provision for displaying the internal system power and wiring conditions. Internal monitors shall include the bell circuit, AC power, battery voltage level, charging voltage, panel box tamper, phone trouble line 1, phone trouble line 2, transmit trouble, and network trouble.

G. Serial Interface
1. The control panel shall be capable of a serial interface to output information to a standard serial printer or serial interface to a communication port on a standard computer. Through control panel programming the system shall include a provision to allow the selection of which reports are to be output.

H. Power Supplies
1. Power supplies for the control unit shall operate from 120 VAC, supplied at the respective protected areas. Standby batteries shall be supplied to power the system in the event of a utility power failure. Batteries shall be sized to provide 105% capacity for eight hours. Standby batteries shall be sealed lead-acid. Power supplies shall be all Solid State.
2. Controls shall be designed to maintain full battery charge when alternating current is available. Batteries shall be recharged to 85% capacity within 24 hours from battery use. The system shall be automatically transferred to battery power upon loss of alternating current power and return to alternating current power upon restoration. Intrusion alarms shall not be initiated during switch over; a signal shall be initiated upon failure of battery or alternating current power.
3. Approved power supplies shall meet or exceed the following power supply model specifications:
   a. UL Listed DMP 505-12: 12VDC 5 amp with transformer and enclosure.
   b. UL Listed DMP 504-24: 24 VDC 4 amps with transformer and enclosure.

I. Software
1. The system shall interface with computer software with the capability to fully program the panel by connecting to the panel through:
   a. Direct cable connection interface card
   b. Receiver phone line connection
   c. Standard phone line connection
   d. Ethernet network connection
   e. Network connection across the Internet
2. The system shall interface with computer software capable of locking down all controlled doors.
3. The system shall interface with computer software capable of monitoring and logging all events.
4. The system shall interface with computer software capable of exporting reports in the following file formats:

Excel spreadsheet (*.xls)	Text (*.txt)
Rich Text (*.rtf)	Comma-separated (*.csv)
Windows Metafile (*.wmf)	HTML document (*.htm)
QuickReport (*.qrp)	

5. The system shall interface with computer software capable of printing custom, filtered reports including:

All Events	Door Access Granted
Zone Action	Door Access Denied
Arming/Disarming	Opening/Closing Schedule Changes
Area Late to Close	System Monitors
User Code Changes	System Events

J. Control Panel Capability
1. The basic control panel shall provide:
   a. Expansion to a total of at least 10,000 user codes with 99 user profile definitions.

b. Sixteen (16) independent door/keypad addresses, each with four zones.
c. Twenty (20) Holiday Dates for custom holiday scheduling by area.
d. A total door access granted event buffer of at least 10,000 events.
e. Anti-passback access control selectable by area and user.
f. Four (4) shift schedules per area.
g. A total of at least 100 programmable output relay schedules.
h. Thirty-two (32) individual reporting areas.
i. Built-in bell and telephone line supervision.

2. The networked control panel shall provide:
   a. All of the above features.
   b. Require two-man access code or credentials.
   c. Support programming to require the same or different access code entered within a programmed delay time of 1 to 15 minutes after disarming before activating a silent ambush alarm.
   d. Support area programming that disables schedule and time-of-day changes while system is armed so that area can only be disarmed during scheduled times.
3. The encrypted control panel shall provide:
   a. All of the basic and network features listed above.
   b. Built-in Encrypted Alarm Router.
   c. Certified operation that meets 128 Bit AES Rijndael Encryption communications.
   d. Certified operation that meets SCIF (Sensitive Compartmented Information Facility) application needs.
   e. Certified operation that meets NIST (National Institute of Standards and Technology) standards.
   f. Certification that encrypted panel is capable of meeting DCID 6/9 standards.
   g. Certification that encrypted panel is capable of meeting UL 2050 standards.

2.4 INTEGRATED INTRUSION ALARM AND ACCESS CONTROL OPERATION

A. Access Authority Levels
1. The system shall be capable of programming access credentials authority levels to check whether the user has access to a specific area and also has the authority to disarm or arm the area. If the user access credential has access and disarm/arm authority the system shall provide the user the option to disarm the area simultaneously upon opening the door, or to open the door and begin an entry delay timer. With the timer option the user then disarms the area using an intrusion control keypad inside the area. If the user only has access authority to the area and the area is in an armed condition, the user is denied access to the area.

B. Door Open Schedule Override
1. The system shall be capable of programming certain area doors to be scheduled to unlock and lock at specific times of the day or night. The lock/unlock function shall be capable of an override option depending upon the area armed/disarmed status. If the area remains in an armed status at the scheduled unlock time the armed status overrides the unlock schedule

ensuring the doors remain locked and armed in situations where the business might open late, close early, is affected by inclement weather, or another emergency.

C. Common Area
1. The system shall be capable of programming a common area to be armed when the last area in the system is armed and disarmed when the first area in the system is disarmed. To ensure the common area works properly it shall not have any user codes assigned to the common area. The system shall also be capable of programming multiple common areas.

D. Early Morning Ambush (XR500N and XR500E only)
1. The system shall be capable of programming an area to require two user codes be entered within a programmed number of minutes to prevent an ambush message from being sent to the Central Station Receiver. If both user codes are not entered within the time an ambush message is sent to the central station receiver.
2. Both user codes shall have the authority to disarm the specific area and must be entered at the same keypad or reader. The keypad shall not display any indication that the ambush timer is running.
3. The system shall be capable of programming an output to provide an external indicator that an ambush situation is taking place.

E. Two-Man Rule (XR500N and XR500E only)
1. The system shall be capable of programming an area to require two separate user codes be entered in order to disarm and/or allow access to a specific area. Both required codes shall have at least the same or greater authority level. Both required codes shall be entered within 30 seconds or an alarm shall activate.

G. Panic Button Summary Test (XR500N and XR500E only)
1. The system shall have the ability to test panic buttons without sending a panic alarm to the Central Station Receiver.
2. The system shall also have the ability to send panic zone test verification and failure results to the Central Station Receiver.
3. During the test, each time a panic zone trips, the display number shall increment and the keypad buzzer sound for two seconds.
4. The number of panic zones tripped shall constantly display until the test ends or no panic zone activity has occurred for 20 minutes.
5. When the Panic Zone Test ends and a zone failed (did not trip) during the test, the keypad shall be able to display the zone name and number and have the buzzer sounds for one second. Additional zone failed zones shall display when a button is pressed.

2.5 FALSE ALARM REDUCTION FEATURES

A. The system shall be capable of providing false alarm reduction features, functions, capabilities, or processes that either require alarms be verified or potential alarms be corrected before a system or zone can be placed into an armed state.

B. Exit Error Alert and Reporting
   1. The panel shall be able to provide an automatic function to prevent a false alarm from occurring if an exit door does not properly close after the system is armed.

C. Entry and Exit Delay Annunciation
   1. When arming, the system shall provide clear annunciation indicators to the user about the need to exit the premises prior to the exit delay time expiring.
   2. When disarming, the system shall notify the user the need to disarm the system prior to the entry delay time expiring.

D. Remote Annunciation
   1. The system shall be able to provide entry and exit delay time period notification. This notification can be from DMP keypads, remote annunciators, or bell tests.

E. Abort Reporting
   1. The system shall be capable of sending an Abort report to the central station if the system is disarmed while the alarm is still sounding. The Abort report shall be sent after the alarm report to notify the central station that an authorized user has cancelled the alarm.

F. System Testing
   1. The system shall offer testing features that are simple, quick, and complete and provide the highest measure of safety by ensuring that alarm conditions are detected and communicated to the proper authorities in a timely manner and on a regularly scheduled basis.

G. Ambush Code
   1. The system shall offer ambush codes for those dangerous encounters where the user is instructed to either arm or disarm the system under threat of harm. The duress code shall disarm the system without giving local indication of an alarm that might put the user well-being in jeopardy.

H. Two-Button Panic Feature
   1. The system shall support DMP keypads that provide the option to use only two-button panic codes. The user shall be required to press and hold two designated keys for approximately two seconds before the system generates a panic alarm.

I. Cross-Zoning Protection
   1. The system shall support cross-zoning as a means of requiring two device trips to occur within a short period of time before sounding an alarm and sending an alarm report to the central station. Supported device trips shall be from one device that trips two times, or from two devices that each trip once.

J. Swinger Zone Bypassing

1. The system shall be capable of automatically bypassing a zone if it goes into an alarm or trouble condition a specified number of times within a one-hour period. The panel shall be able to track the number of times the zone trips while armed and compare that against a programmed number. When that number is reached, the panel shall be able to automatically bypass the zone. The panel shall be capable of resetting the zone when the area to which it is assigned disarms, is manually reset from the keypad or remotely, or remains normal for one hour.

K. Recently Armed Report
1. The system shall be capable sending a System Recently Armed report, along with a zone alarm report, to the central station any time an alarm occurs within five minutes of the system arming. The System Recently Armed report allows the central station operator to follow a "call the subscriber first" procedure instead of immediately dispatching the police to what could be a false alarm.

L. Transmit Delay
1. The system shall be capable of programming the panel to wait up to 60 seconds before sending burglary alarm reports to the central station. If an alarm is accidental, the user shall be able to disarm the system within the programmed Transmit Delay time. An Abort report shall be sent in place of an alarm report after the system disarms. During the alarm, sirens and panel relay outputs shall not be delayed and shall still provide local condition annunciation.

M. Call Waiting Cancel
1. The system shall be capable of being programmed to cancel call waiting any time the panel dials the receiver number to send a report.

N. Cancel/Verify
1. The system shall be capable of sending either a Cancel Report or Verify Report to the Central Station to signify that the end user has Canceled an Alarm or Verified an Alarm condition.

2.6 BURGLARY CONTROL

A. Area System
1. The system user shall be capable of selectively arming and disarming any one or more of 32 areas within the intrusion detection system based on the user PIN code and/or keypad used. Each of the 574 zones shall be able to be assigned to any of the 32 available areas. The system shall be capable of having up to a sixteen (16) character length name programmed for each area.
2. The system user shall be capable of assigning an opening and closing schedule to all areas or to each of the 32 areas separately. Each area shall be able to arm or disarm automatically by a schedule. The system shall have the capacity for common areas that automatically disarm when any other area disarms and that automatically arm when all others areas arm.

3. The networked system shall have the ability to comply with Bank Safe & Vault application. The networked system shall also have the ability to use a two-man rule for disarming or allowing door access to an area. The system shall have the ability to operate a Common Area application.

B. Zones
1. The system shall have a minimum of eight (8) grounded burglary zones available from the control panel.

C. Burglary Equipment
1. Burglary detection equipment shall communicate to the system by way of the control panel loop expansion bus or 900MHz receiver.

2.7 ACCESS CONTROL

A. Keypad
1. The system shall display a message at any keypad when any system area remains disarmed past the scheduled closing time. The message shall be displayed at one minute past the scheduled closing time. A pre-warn tone shall also begin sounding. If the system is not armed or a schedule extended within ten minutes past the scheduled closing time, the system shall provide the option of sending a Late To Close report to the central station.
2. The keypad shall include a door strike relay capable of sending a report to the central station when activated.
3. The keypad shall be capable of proximity arming and disarming functions.

B. Area Access Control
1. The system shall be capable of integrating area access control capability where specified into the same control panel with the ability to have up to 10,000 user credentials. User access is limited to custom profiles and/or schedules. Anti-passback shall be available. The networked version shall support a Two-Man Rule feature. The system shall support up to sixteen (16) access doors, connected to the system using a manufacturer-approved interface module.
2. Area door access products shall meet or exceed features offered by the following products:
3. Keypad reader/administration device – DMP Model 7063/7063A, 7073/7073A, 7163, 7173
4. Wiegand Interface – DMP Model 733, 734
5. Reader – DMP Model PP-6005B, Model PR-5455, Model MP-5365
6. Cards or credentials – DMP Model 1326, DMP Model 1306P, DMP Model 1346, DMP Model 1386

C. Access Control Equipment
1. Access Control equipment shall communicate to the system by way of the control panel keypad bus.

2.8 COMPILED DETECTION EQUIPMENT LISTING

A. Hard-wired

1. Hard-wired detection equipment shall communicate to the system by way of the control panel loop expansion bus. The equipment shall have a three (3) year warranty as stated in the current DMP Product Catalog and meet or exceed features offered in the following products:

d. Door Contact – DMP Model SD70 (concealed applications – requires DMP zone expander)
f. Door Contact – DMP Model SM20WG (surface applications – requires DMP zone expander)

B. Wireless
1. Wireless detection equipment shall communicate to the system by way of a compatible 900MHz receiver utilizing two way communications, capable of receiving up to 500 wireless zones. The wireless system shall be programmed directly from the control panel, and shall not require a separate device programmer. The wireless detection equipment shall have a one (1) year warranty. It shall be capable of sending transmitter and battery status to the control panel's compatible receiver up to once every 60 seconds and must meet or exceed the following products:
   a. Input transmitter – DMP Model 1101, 1102
   b. Pendant Panic Transmitter – DMP Model 1147, 1146, 1145
   c. Panic Transmitter – DMP Model 1142
   d. Wireless Receiver – DMP Model 1100X, 1100XI, 1100XH

C. Notification Devices
1. Notification equipment shall be control panel activated by way of the supervised bell output module. The equipment shall have a three (3) year warranty as stated in the current DMP Product Catalog and meet or exceed features offered in the following products:
   a. Bells – Wheelock Model MB-G6-12, MB-G10-12, MB-G6-24, MB-G10-24
   b. Horns – Wheelock Model MT-12/24, NH-12/24, MIZ-24, AH-24, AH-24WP
   c. Strobe – Wheelock Model RSS-121575W, RSS-24MCW
   d. Horn Strobe – Wheelock Model MTWP=2475W, NS-121575W, NS-24MCW, AS-24MCW
   e. Notification Modules – DMP Models 865, 866, 867,
   f. Notification/Synchronization Modules – DMP Models 831, 832

D. Power Supplies and Transformers
1. Power supply, transformer, and battery devices shall maintain system operation. The batteries shall be checked and replaced every three to five years. The equipment shall have a three (3) year warranty as stated in the current DMP Product Catalog and meet or exceed features offered in the following products:
   a. Power Supply – DMP Model 505-12, 115 VAC, 12 VDC
   b. Power Supply – DMP Model 505-12LX, 115 VAC, 12 VDC
   c. Transformer - DMP Model 327, 16.5 VAC 50 VA, Plug-in
   d. Transformer - DMP Model 322, 16.5 VAC 56 VA, Wire-in
   e. Transformer - DMP Model 323, 16.5 VAC 56 VA, Wire-in

E. Access Control Equipment

1. Access control equipment shall provide access control functions between the panel and controller door access points. The equipment shall have a three (3) year warranty as stated in the current DMP Product Catalog and meet or exceed features offered in the following products:
   a. Interface Module – DMP Model 734, Wiegand
   b. Egress Module – DMP Model PB-2 REX Button
   c. Reader – DMP Model PP-6005B Proxpoint Plus©
   d. Reader – DMP Model MP-5365 Miniprox©
   e. Reader – DMP Model MX-5375 Maxi-Prox™
   f. Reader – DMP Model TL-5395 Thinkline II™
   g. Door Controller – DMP Model 1306P Prox Patch™
   h. Door Controller – DMP Model 1306PW Prox Patch™
   i. Access Card – DMP Model 1351 ProxPass© Card
   j. Access Card – DMP Model 1326 Proxcard II© Card
   k. Access Device – DMP Model 1346 Proxkey II™ Keyfob, 1386 Isoprox II©

PART 3: EXECUTION

3.1 INSTALLATION

A. Integration with Access & Security Management Software
   1. Provide all licensing, modules, programming, configuration, graphical backgrounds, etc. as required to integrate with the District's WAN access & security management software and support all utilized features.
2. Provide any available software updates to the access & security management software.

B. Connection of master control unit to expansion modules shall be accomplished via the fiber optic cables common to the data network. There will be no separate OSP copper cabling allowed for the intrusion system.

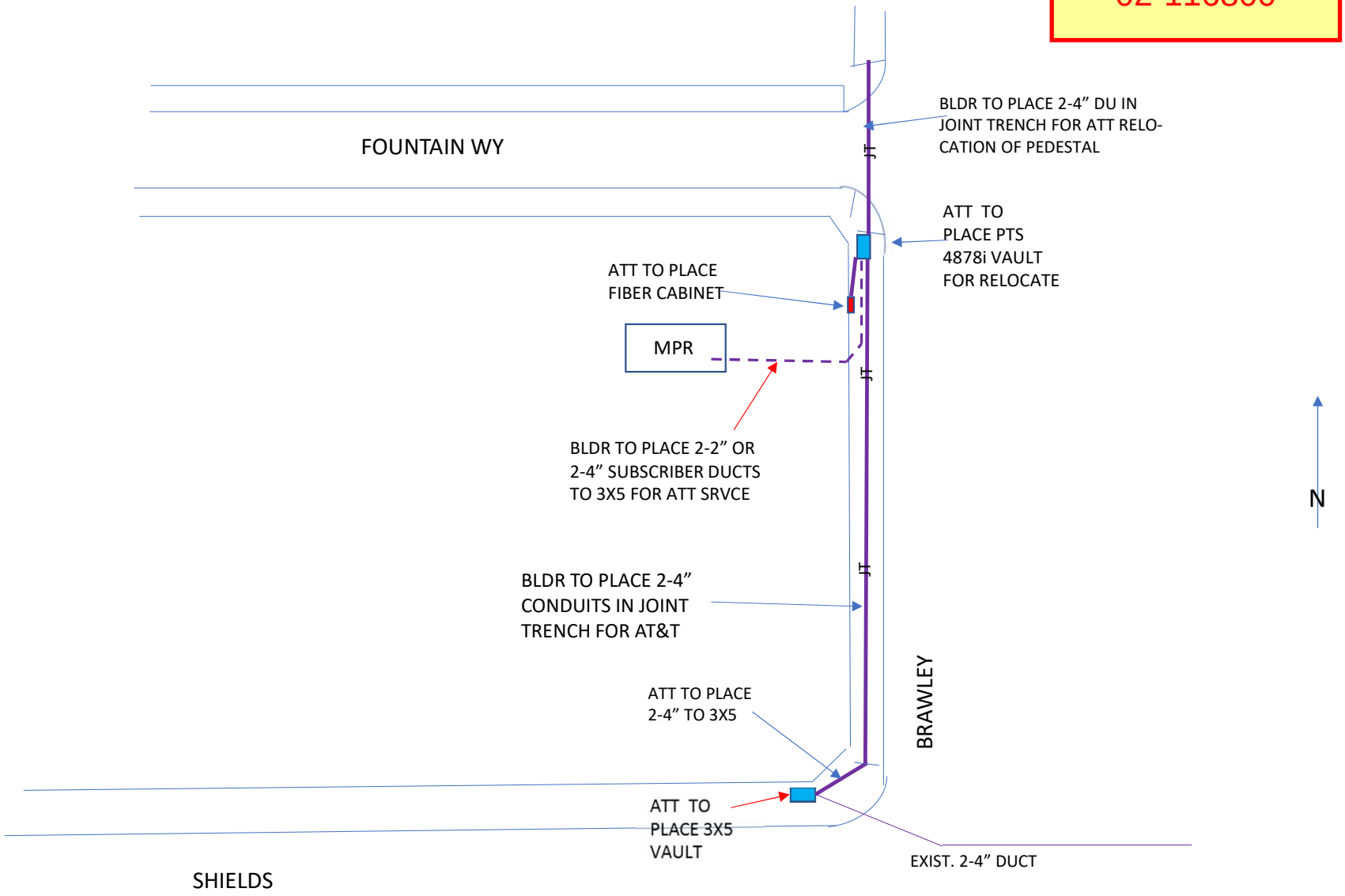
C. Each intrusion device (door/window magnetic switch, glass break sensor, motion sensor, etc.) shall be connected to a dedicated zone. Provide zone expansion modules as needed.

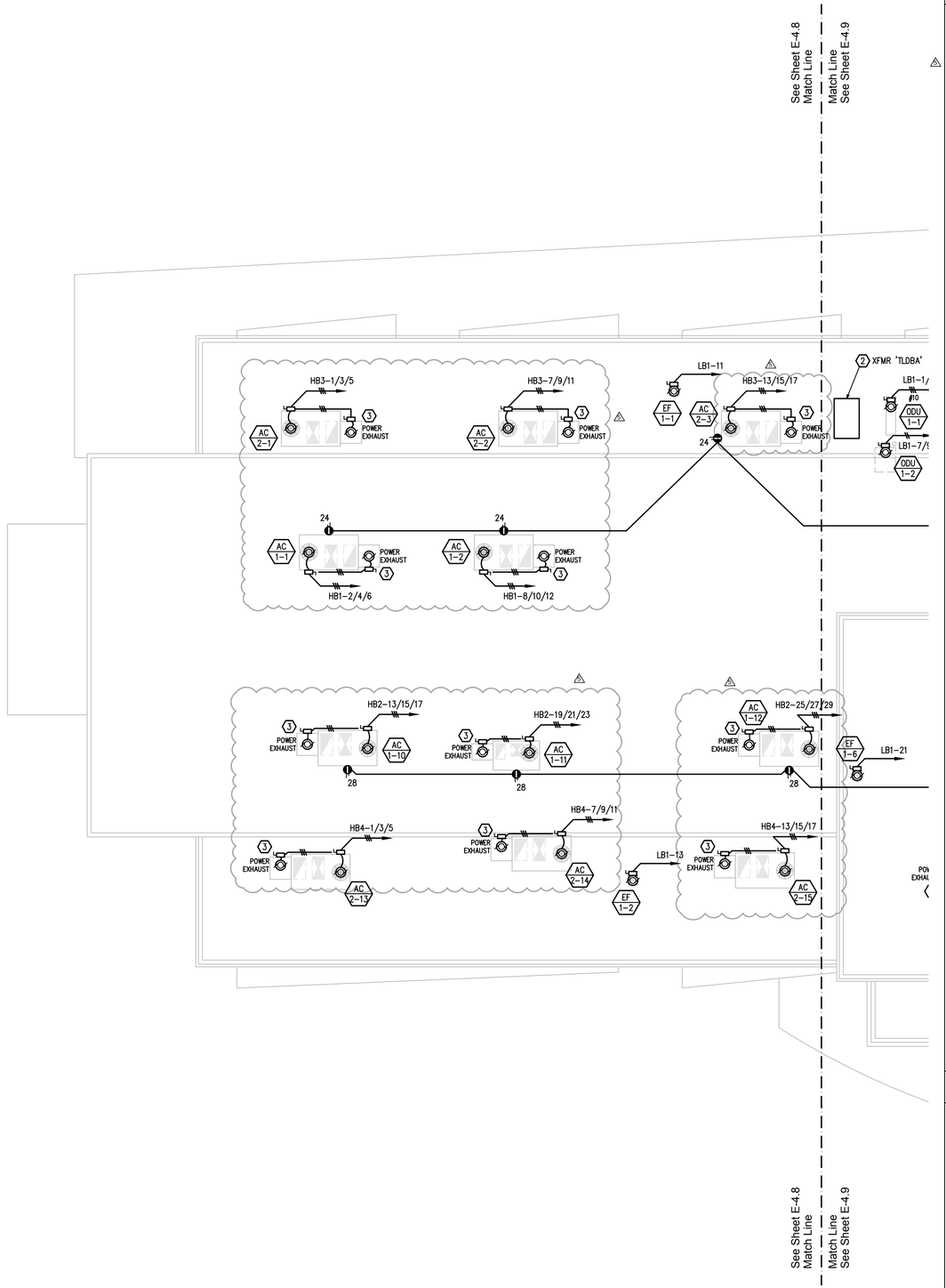
D. Provide all wiring to devices and components in accordance with the manufacturer's recommendation.

END OF SECTION

Received 05/24/2023 from AT&T
From Brian Weldon 559-548-0736

AD 5-18a
S&B Elemenatary
02-116800





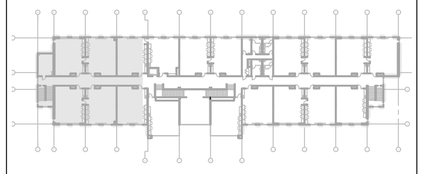
1 ELECTRICAL ROOF PLAN
MAIN BUILDING

SCALE: 1/8" = 1'-0"

KEYNOTES

1. 3/4"C. 3#8, 1#10G.
2. ROOF MOUNT TRANSFORMER, SEE DETAIL 5/E0.4.
3. TAP SECONDARY SIDE OF UNIT DISCONNECT, PROVIDE ADDITIONAL WP FUSED DISCONNECT, AND CONNECT POWER EXHAUST.

KEY PLAN



Hardin-Davidson Engineering
356 Pollasky Ave.
Suite 200
Clovis, CA 93612
559.323.4995 tel
559.323.4928 fax

REGISTERED PROFESSIONAL ENGINEER C. SCOTT DAVIDSON E17850 ELECTRICAL STATE OF CALIFORNIA

SIMPBK

PROJECT:

SHIELDS & BRAWLEY ELEMENTARY SCHOOL

CENTRAL UNIFIED SCHOOL DISTRICT

AD 5-19a
S&B Elementary
02-116800

JOHN H. SMITH, A.I.A. C15885

LICENSED ARCHITECT JOHN HAMILTON SMITH C 15885 9-30-23 RENEWAL DATE STATE OF CALIFORNIA

PROJECT DEVELOPMENT

DATE	ISSUED FOR

REVISIONS

No.	DATE	DESCRIPTION
1	2.14.23	DISTRICT MODIFICATIONS
2	2.27.23	DISTRICT MODIFICATIONS
3	4.19.23	DISTRICT MODIFICATIONS
4	5.25.23	ADDED POWER EXHAUST TO HVAC

SHEET DESCRIPTION

ELECTRICAL ROOF PLAN

MAIN BUILDING

PROJECT COORDINATOR: JOHN SMITH	SHEET No. E4.8
PROJECT NO.: 17-67	
DATE: 1.27.23	
SCALE: AS NOTED	

PLOT DATE: 5/25/2023 9:01 AM
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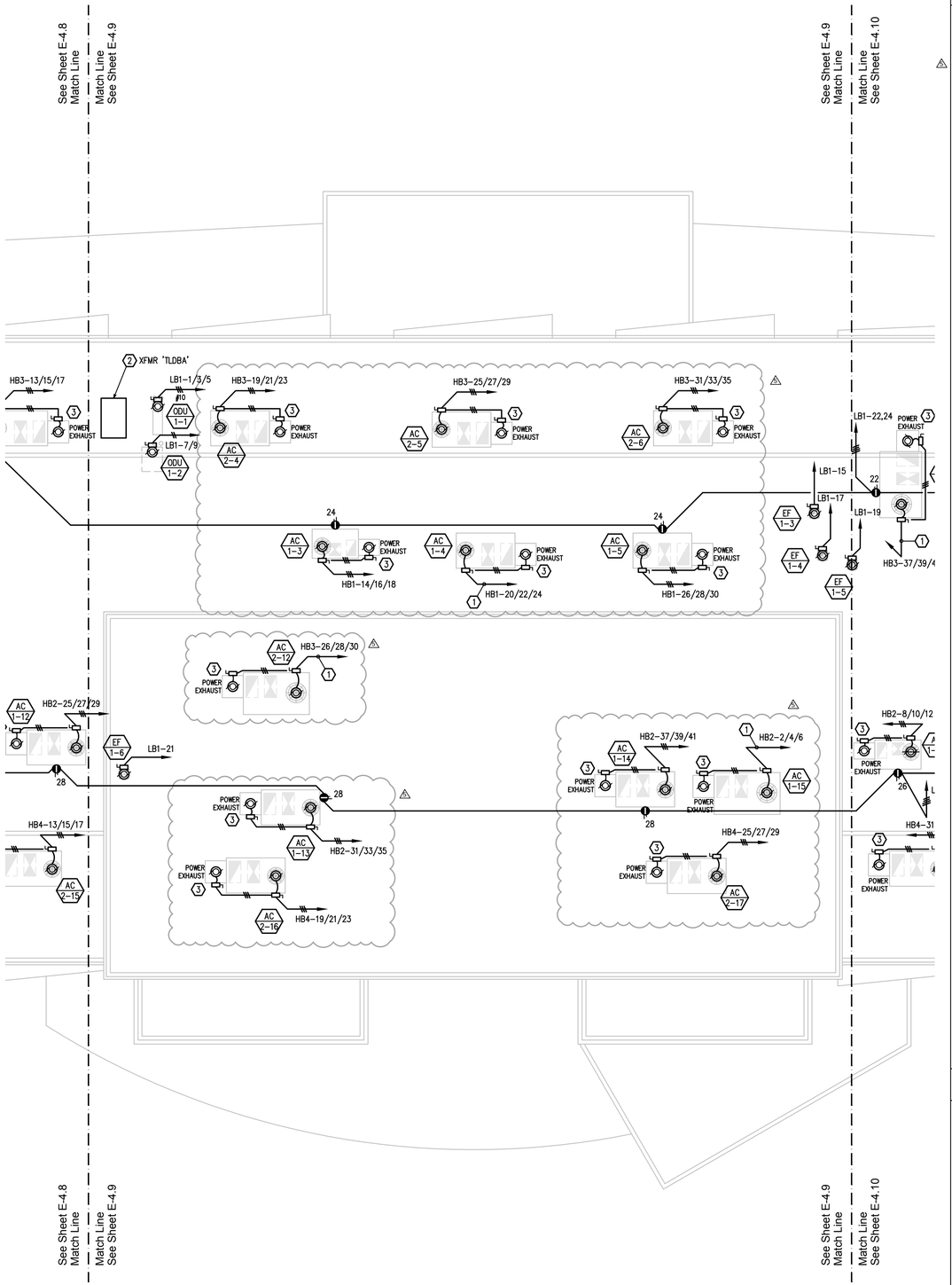

KEYNOTES ⬡

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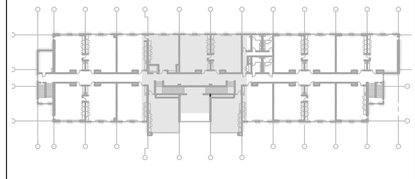
KEY PLAN



Hardin-Davidson Engineering
356 Pollasky Ave. Suite 200
Clovis, CA 93612
559.323.4995 tel
559.323.4928 fax

SIMPBK

PROJECT:

SHIELDS & BRAWLEY ELEMENTARY SCHOOL

CENTRAL UNIFIED SCHOOL DISTRICT

AD 5-20a
S&B Elementary
02-116800

JOHN H. SMITH, A.I.A. C15885

LICENSED ARCHITECT JOHN HAMILTON SMITH C 15885 9-30-23 RENEWAL DATE STATE OF CALIFORNIA

PROJECT DEVELOPMENT

DATE	ISSUED FOR

REVISIONS

No.	DATE	DESCRIPTION
1	2.14.23	DISTRICT MODIFICATIONS
2	2.27.23	DISTRICT MODIFICATIONS
3	4.19.23	DISTRICT MODIFICATIONS
4	5.25.23	ADDED POWER EXHAUST TO HVAC

SHEET DESCRIPTION

ELECTRICAL ROOF PLAN

MAIN BUILDING

REGISTERED PROFESSIONAL ENGINEER C. SCOTT DAVIDSON E17850 ELECTRICAL STATE OF CALIFORNIA

PROJECT COORDINATOR: JOHN SMITH	SHEET No. E4.9
PROJECT NO.: 17-67	
DATE: 1.27.23	
SCALE: AS NOTED	

PLOT DATE: 5/25/2023 9:01 AM
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1 ELECTRICAL ROOF PLAN
MAIN BUILDING
SCALE: 1/8" = 1'-0"

KEYNOTES

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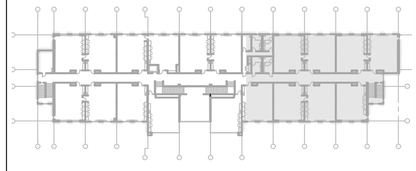
3. TAP SECONDARY SIDE OF UNIT DISCONNECT, PROVIDE ADDITIONAL WP FUSED DISCONNECT, AND CONNECT POWER EXHAUST.

KEY PLAN



Hardin-Davidson Engineering
356 Pollasky Ave.
Suite 200
Clovis, CA 93612
559.323.4995 tel
559.323.4928 fax

REGISTERED PROFESSIONAL ENGINEER
C. SCOTT DAVIDSON
E17850
ELECTRICAL
STATE OF CALIFORNIA

SIMPBK

PROJECT:

SHIELDS & BRAWLEY ELEMENTARY SCHOOL

CENTRAL UNIFIED SCHOOL DISTRICT
Until Higher, Every Classroom, Every Day!

AD 5-21a
S&B Elementary
02-116800

JOHN H. SMITH, A.I.A. C15885

LICENSED ARCHITECT
JOHN HAMILTON SMITH
C 15885
9-30-23
RENEWAL DATE
STATE OF CALIFORNIA

PROJECT DEVELOPMENT

DATE	ISSUED FOR

REVISIONS

No.	DATE	DESCRIPTION
1	2.14.23	DISTRICT MODIFICATIONS
2	2.27.23	DISTRICT MODIFICATIONS
3	4.19.23	DISTRICT MODIFICATIONS
4	5.25.23	ADDED POWER EXHAUST TO HVAC

SHEET DESCRIPTION

ELECTRICAL ROOF PLAN

MAIN BUILDING

PROJECT COORDINATOR: JOHN SMITH	SHEET No.
PROJECT NO.: 17-67	E4.10
DATE: 1.27.23	
SCALE: AS NOTED	

PLOT DATE: 5/25/2023 9:01 AM
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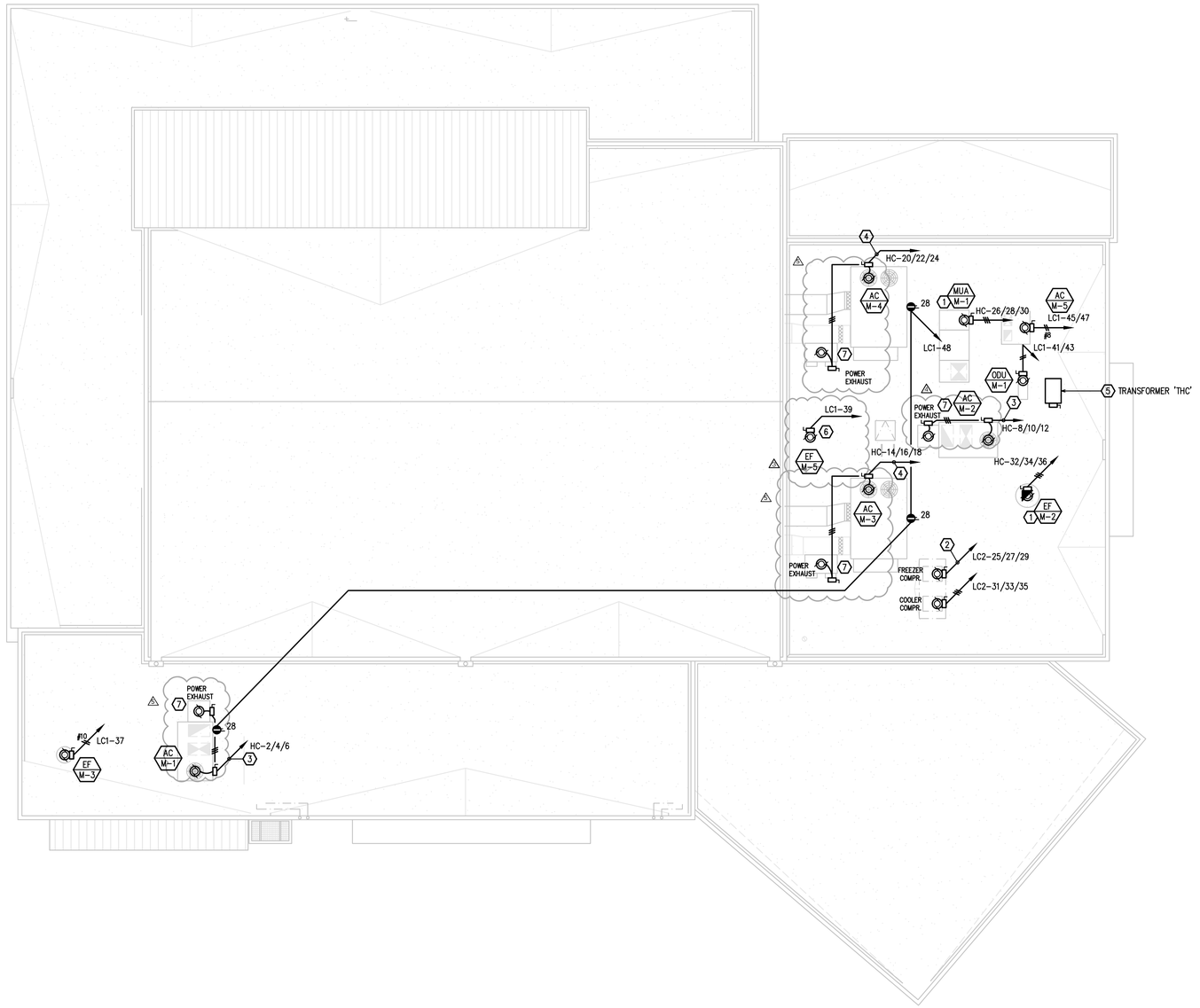

1 ELECTRICAL ROOF PLAN
MULTI-PURPOSE

SCALE: 1/8" = 1'-0"

N

KEYNOTES

1. HOMERUN TO ELECTRICAL PANEL VIA KITCHEN HOOD CONTROLLER MOTOR STARTERS. SEE HOOD DRAWINGS AND MECHANICAL SHEETS FOR ALL REQUIREMENTS.
2. 1"C. 3#8, 1#10G.
3. 3/4"C. 3#10, 1#10G.
4. 1 1/4"C. 3#3, 1#8G.
5. ROOF MOUNT TRANSFORMER, SEE DETAIL 5/E0.4.
6. PROVIDE HOOD SWITCH TO CONTROL DISHWASHER EXHAUST FAN. LOCATE PER VENDOR. ALSO INTERCONNECT CIRCUIT WITH MUA-M-1 AS PER MECHANICAL.
7. TAP SECONDARY SIDE OF UNIT DISCONNECT, PROVIDE ADDITIONAL WP FUSED DISCONNECT, AND CONNECT POWER EXHAUST.

SIMPBK

PROJECT:

SHIELDS & BRAWLEY ELEMENTARY SCHOOL

AD 5-22a
S&B Elementary
02-116800

JOHN H. SMITH, A.I.A. C15885

LICENSED ARCHITECT JOHN HAMILTON SMITH C 15885 9-30-23 RENEWAL DATE STATE OF CALIFORNIA

PROJECT DEVELOPMENT

DATE	ISSUED FOR

REVISIONS

No.	DATE	DESCRIPTION
1	2.14.23	DISTRICT MODIFICATIONS
2	2.27.23	DISTRICT MODIFICATIONS
3	4.19.23	DISTRICT MODIFICATIONS
4	5.25.23	ADDED POWER EXHAUST TO HVAC

SHEET DESCRIPTION

ELECTRICCAL ROOF PLAN

MULTI-PURPOSE

PROJECT COORDINATOR: JOHN SMITH	SHEET No. E4.11
PROJECT NO.: 17-67	
DATE: 1.27.23	
SCALE: AS NOTED	

REGISTERED PROFESSIONAL ENGINEER C. SCOTT DAVIDSON E17850 ELECTRICAL STATE OF CALIFORNIA

Hardin-Davidson Engineering
356 Pollasky Ave.
Suite 200
Clovis, CA 93612
559.323.4995 tel
559.323.4928 fax

PLOT DATE: 5/25/2023 9:01 AM
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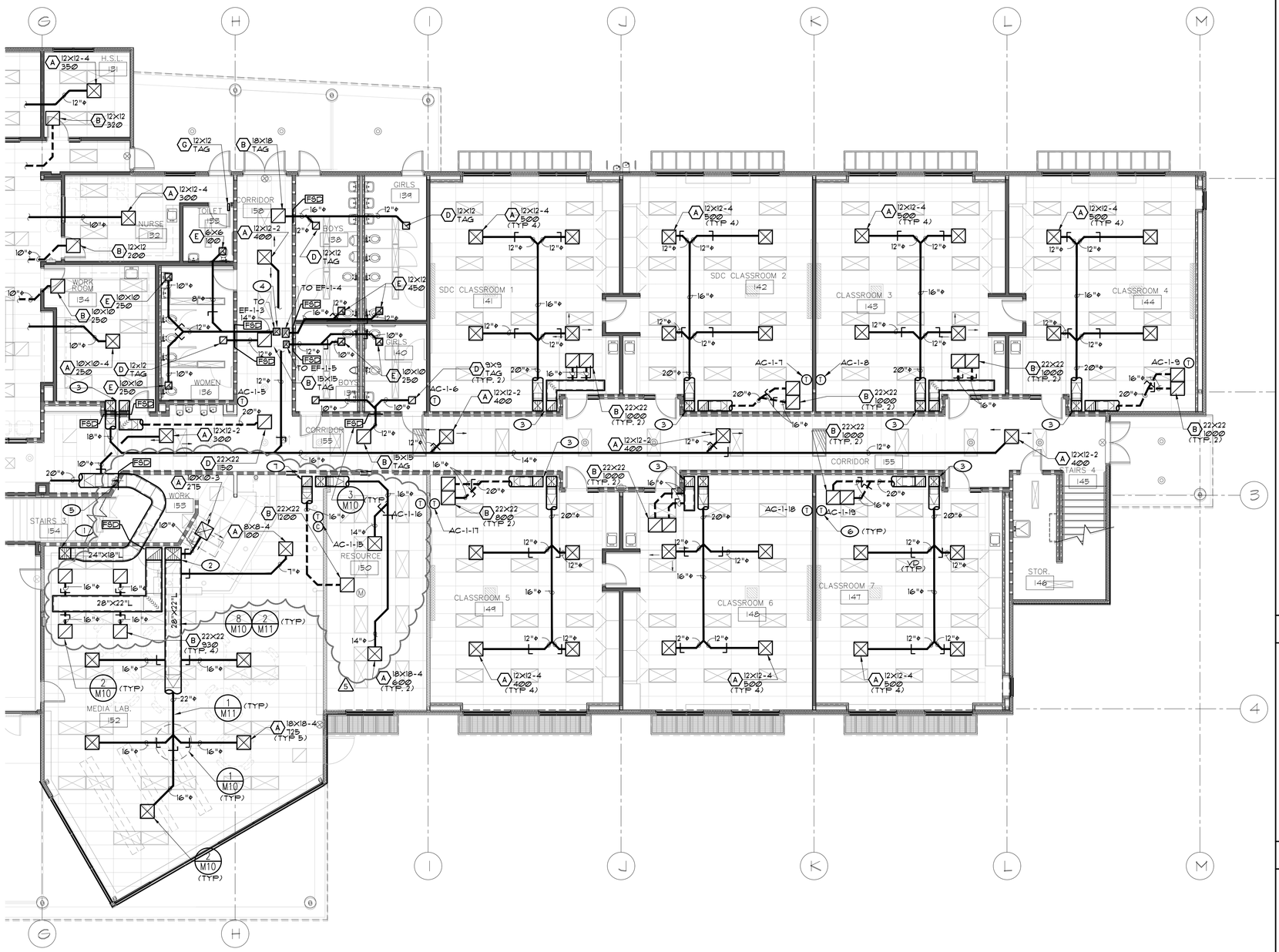
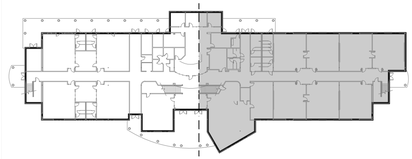


KEYNOTES

1. 20"X20"L SA DROP FROM 2ND FLOOR TO 1ST FLOOR ATTIC SPACE.
2. 28"X22"L SA/RA DROP FROM 2ND FLOOR TO 1ST FLOOR ATTIC SPACE.
3. 18"X18"L SA/RA DROP FROM 2ND FLOOR TO 1ST FLOOR ATTIC SPACE.
4. EXHAUST DUCT UP TO SECOND FLOOR CHASE:
   12"X12" TO EF-1-3
   12"X16" TO EF-1-4
   10"X12" TO EF-1-5.
   SEE SHEET M6 FOR CONTINUATION.
5. OFFSET DUCTWORK UP WITH TURNING VANES IN 45° ELBOWS TO HALLWAY ATTIC. DUCTWORK OVER WORK AREA SHALL BE KEPT TIGHT UP TO BOTTOM OF FRAMING.
6. THERMOSTAT AT 48" AFF TO TOP OF BOX. ALL WIRE SHALL BE INSIDE CONDUIT CONCEALED IN WALL AND ATTIC.
7. 14"x15"L SA/RA DROPS FROM 2ND. FLOOR

KEY PLAN



WALL LEGEND

1 HR RATED WALL

SIMPBK
7790 NORTH PALM AVENUE
FRESNO, CALIFORNIA 93711
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PROJECT:

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JOHN H. SMITH, A.I.A. C15885
LICENSED ARCHITECT JOHN HAMILTON SMITH C 15885 9-30- RENEW DATE STATE OF CALIFORNIA

PROJECT DEVELOPMENT

DATE	ISSUED FOR

REVISIONS

No.	DATE	DESCRIPTION
1	5.19.23	ADDENDUM 3
2	5.25.23	ADDENDUM 5

SHEET DESCRIPTION

MECHANICAL FLOOR PLAN

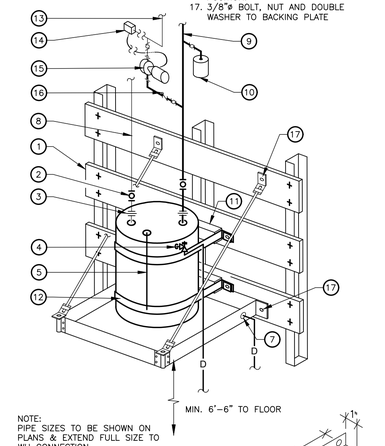
MAIN – 1ST FLOOR

REGISTERED PROFESSIONAL ENGINEER GAREN M. LENGOMIN NO. 19011 REN. 6/30 MECHANICAL STATE OF CALIFORNIA

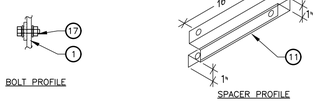
LEAF ENGINEERS A PBK COMPANY
895 W. Ashlan Ave, Suite 101 Clovis, CA 93612
p 559-223-9600 www.LEAFengineers.com
job #: 18-1024

PROJECT COORDINATOR	SHEET No.
JOHN SMITH	M4
PROJECT NO. 17–67	
DATE 3.30.23	
SCALE AS NOTED	

1. 1/4"THICK STEEL PLATE. BOLT TO MINIMUM 3 STUDS W/ MIN. (2) #8 X 1" SMS
2. BALL VALVE. (TYP)
3. UNION. (TYP)
4. TEMPERATURE & PRESSURE RELIEF VALVE WITH FULL SIZE DRAIN TO MOP SINK.
5. MAGNESIUM ANODE.
6. HOLDRITE QUICK STAND WALL MOUNTED WATER HEATER PLATFORM, 24"x24"x4" 18 GA. GALV. SHEET METAL WITH 3/4" DRAIN CONNECTION.
7. 3/4" DRAIN TO MOP SINK.
8. HOT WATER OUTLET.
9. COLD WATER INLET.
10. AMTROL ST-5 THERM-X-TROL EXPANSION TANK.
11. PROVIDE 18 GA. GALV. METAL SPACERS TO HOLD WATER HEATER AT 1" MIN. DISTANCE FROM WALL. 5/16"ø BOLT, NUT AND DOUBLE WASHER TO BACKING PLATE, LENGTH AS REQUIRED (4) PER SPACER.
12. HOLDRITE QUICK STRAP (2) 2" x 24 GA. S.M. STRAPS. LOCATE STRAPS ON UPPER AND LOWER THIRD OF WATER HEATER. DRILL AND TAP TO STEEL PLATE. 3/8"ø BOLT, NUT AND DOUBLE WASHER TO BACKING PLATE, LENGTH AS REQUIRED, TYP. (1) EA. END OF STRAP.
13. HOT WATER RETURN.
14. AQUASTAT MH NO. L4006A SET TO START AT 115 DEGREES AND STOP AT 120 DEG. LOCATE MIN. 10'-0" UP STREAM FROM WATER HEATER.
15. CIRCULATING PUMP – SEE PLUMBING SCHEDULE.
16. CHECK VALVE MOUNT IN HORIZONTAL POSITION.
17. 3/8"ø BOLT, NUT AND DOUBLE WASHER TO BACKING PLATE

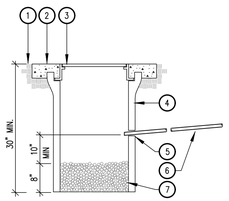


NOTE:
PIPE SIZES TO BE SHOWN ON PLANS & EXTEND FULL SIZE TO WH CONNECTION.



15 P11 WALL MOUNTED ELECTRIC WATER HEATER

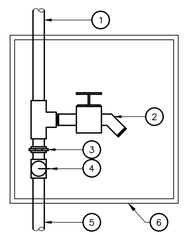
OPERATING WEIGHT: 243 LBS. MAX. NTS



1. FINISHED GRADE
2. CAST CONCRETE AROUND UNPAVED AREA.
3. SOLID CAST IRON LID W/ RETAINING BOLTS
4. BELL OF 24" DIA TILE PIPE
5. SEAL AROUND PIPE
6. CONDENSATE DRAIN LINE. PITCH 1/8"/LIN. FT BELOW GRADE.
7. GRAVEL BED

16 P11 CONDENSATE DRAIN DRYWELL

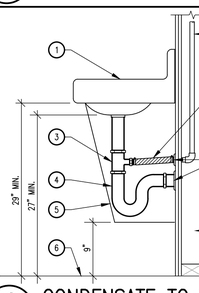
NTS



1. 3/4" CW TO ROOF TOP EVAPORATIVE COOLER
2. 3/4" HOSE BIBB– FOR DRAIN DOWN AT WINTER SHUT–DOWN OF EVAPORATIVE COOLER. 3/4" THREADED END.
3. COPPER THREADED UNION.
4. BRONZE THREADED BALL VALVE.
5. 3/4" CW SUPPLY.
6. RECESS WALL BOX 12"X12"X4" DEEP. COORDINATE WITH OWNER THE EXACT LOCATION. SMITH 4740 WITH VANDAL PROOF SCREWS.

11 P11 E.C. COLD WATER VALVE

NTS



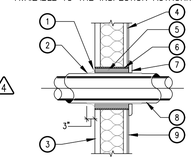
1. LAVATORY OR SINK
2. NOT USED
3. SLIP–JOINT FITTING
4. TRAP
5. AREA CLEAR FOR HANDICAP
6. FINISHED FLOOR
7. 3/4" CONDENSATE DRAIN IN WALL.
8. NEOPRENE HOSE & CLAMPS
9. ESCUTCHEON PLATE
10. WALL

NOTE:
SEE ARCHITECT'S DRAWINGS FOR HANDICAP REQUIREMENTS.

12 P11 CONDENSATE TO TAILPIECE DETAIL

NTS

NOTE:
PENETRATIONS IN WALL, FLOOR OR CEILING REQUIRING PROTECTED. OPENING SHALL BE FIRE STOPPED. FIRE STOPPING SHALL BE OF AN APPROVED MATERIAL, SECURITY INSTALLED AND CAPABLE OF MAINTAINING ITS INTEGRITY WHEN SUBJECTED TO THE TIME–TEMPERATURE CURVE OF STATE FIRE MARSHAL STANDARD 12–43–3 AND STANDARD 12–43–L MANUFACTURER'S INSTALLATIONS INSTRUCTIONS SHALL BE MADE AVAILABLE TO THE INSPECTION AUTHORITY AND KEPT AT THE JOB SITE.

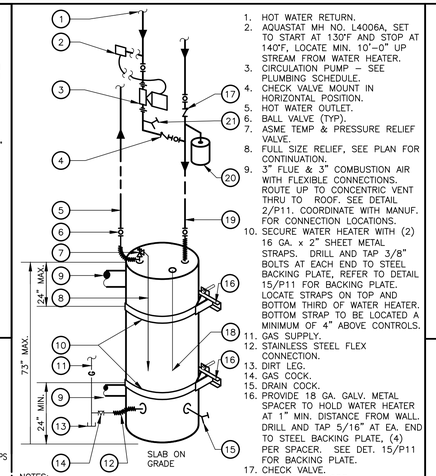


1. SEALANT–JOINT, 1/4" MIN. WIDTH BY 3/8" DEEP.
2. METAL JACKET ON INSULATED PIPE.
3. EXTERIOR FACE OF WALL.
4. FRAMED WALL.
5. BACKUP MATERIAL.
6. SLEEVE.
7. ESCUTCHEON.
8. INSULATION WHERE INDICATED.
9. INTERIOR FACE OF WALL.

FIRE PROOFING MATERIALS: U.L. 1479 TO ARCHIVE FIRE RATING NOTED ON DRAWINGS IN ACCORDANCE WITH THE UNDERWRITERS LABORATORIES INC. FIRE RESISTANCE DIRECTORY, THROUGH PENETRATION FIRE STOP SYSTEM NUMBER 147 AND 148

13 P11 TYPICAL PIPE THRU FIRE RATED WALL

NTS



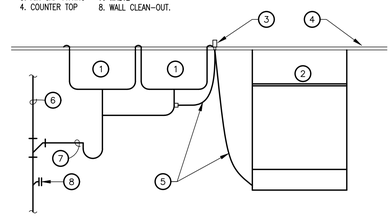
1. HOT WATER RETURN.
2. AQUASTAT MH NO. L4006A, SET TO START AT 130°F AND STOP AT 140°F, LOCATE MIN. 10'–0" UP STREAM FROM WATER HEATER.
3. CIRCULATION PUMP – SEE PLUMBING SCHEDULE.
4. CHECK VALVE MOUNT IN HORIZONTAL POSITION.
5. HOT WATER OUTLET.
6. BALL VALVE (TYP).
7. ASME TEMP & PRESSURE RELIEF VALVE.
8. FULL SIZE RELIEF, SEE PLAN FOR CONTINUATION.
9. 3" FLUE & 3" COMBUSTION AIR WITH FLEXIBLE CONNECTIONS. ROUTE UP TO CONCENTRIC VENT THRU TO ROOF. SEE DETAIL 2/P11. COORDINATE WITH MANUF. FOR CONNECTION LOCATIONS.
10. SECURE WATER HEATER WITH (2) 16 GA. x 2" SHEET METAL STRAPS. DRILL AND TAP 3/8" BOLTS AT EACH END TO STEEL BACKING PLATE, REFER TO DETAIL 15/P11 FOR BACKING PLATE. LOCATE STRAPS ON TOP AND BOTTOM THIRD OF WATER HEATER. BOTTOM STRAP TO BE LOCATED A MINIMUM OF 4" ABOVE CONTROLS.
11. GAS SUPPLY.
12. STAINLESS STEEL FLEX CONNECTION.
13. DIRT LEG.
14. GAS COCK.
15. DRAIN COCK.
16. PROVIDE 18 GA. GALV. METAL SPACER TO HOLD WATER HEATER AT 1" MIN. DISTANCE FROM WALL. DRILL AND TAP 5/16" AT EA. END TO STEEL BACKING PLATE, (4) PER SPACER. SEE DET. 15/P11 FOR BACKING PLATE.
17. CHECK VALVE.
18. MAGNESIUM ANODE.
19. COLD WATER INLET.
20. AMTROL ST–25V THERM–X–TROL EXPANSION TANK.
21. HOSE BIBB.

NOTES:
1. PIPE SIZES TO BE SHOWN ON PLANS & EXTENDED FULL SIZE TO WH CONNECTION.
2. IF CIRCULATING PUMP IS MOUNTED HORIZONTALLY PROVIDE AN AUTOMATIC AIR RELEASE VALVE AT MAXIMUM 4 FEET FROM INLET.

8 P11 GAS WATER HEATER

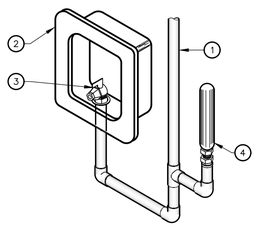
OPERATING WEIGHT: 630 LBS. MAX. NTS

1. SINK
2. DISHWASHER
3. AIR GAP FITTING
4. COUNTER TOP
5. 3/4" HOSE
6. VENT
7. WASTE
8. WALL CLEAN–OUT.



9 P11 TYPICAL DISHWASHER HOOK–UP

NTS

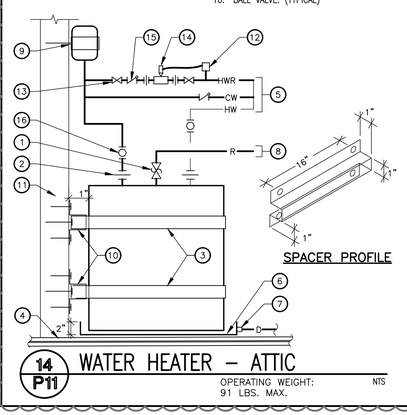


1. COLD WATER INLET.
2. RECESSED WALL BOX.
3. BALL VALVE.
4. WATER HAMMER ARRESTER PDI–A.

10 P11 COLD WATER SUPPLY BOX FOR REFRIGERATOR ICE MAKER

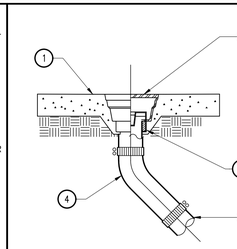
NTS

1. ASME T & P RELIEF VALVE
2. DIELECTRIC UNIONS (TYP.).
3. SECURE WH WITH (2) 16 GA. x 2" SHEET METAL STRAPS TO MIN. 4x BLOCKING IN WALL. ATTACH 4x BLOCKING TO STUDS WITH SIMPSON A34 TOP AND BOTTOM EACH END. 3–8d NAILS PER A34 LEG. LOCATE STRAPS ON TOP AND BOTTOM THIRD OF WATER HEATER. BOTTOM STRAP TO BE LOCATED A MINIMUM OF 4" ABOVE CONTROLS. 3/8" LAG BOLT W/ 3" MIN. EMBED. TO WOOD FRAMING. (2) REQUIRED PER STRAP.
4. ATTIC PLATFORM (DESIGNED BY ARCH.).
5. 1" HW TO FIXTURES, 1" CW SUPPLY. 3/4" HWR FROM FIXTURES.
6. 20 GA. GALV. STEEL PAN W/SOLDERED JOINTS.
7. 3/4" DRAIN TO OUTSIDE (SEPARATE FROM RELIEF DRAIN).
8. FULL SIZE T & P RELIEF TO OUTSIDE WALL, TERMINATE AT 6" ABOVE GRADE.
9. AMTROL ST–5 THERM–X–TROL EXPANSION TANK. SECURE WITH (1) STRAP TO WALL PER NOTE 3.
10. PROVIDE 18 GA. GALV. METAL SPACERS TO HOLD WATER HEATER AT 1" MIN. DISTANCE FROM WALL. #10 SMS FOR METAL FRAMING. (4) PER SPACER CENTERED IN STUDS.
11. METAL WALL FRAMING WITH BACKING PLATES.
12. AQUASTAT MH NO. L4006A SET TO START AT 115' AND STOP AT 120'. LOCATE MIN. 10'–0" UP STREAM FROM WATER HEATER.
13. SHUT OFF VALVE. (TYPICAL).
14. CIRCULATING PUMP. SEE PLUMBING SCHEDULE.
15. CHECK VALVE, MOUNT IN HORIZONTAL POSITION.
16. BALL VALVE. (TYPICAL)



14 P11 WATER HEATER – ATTIC

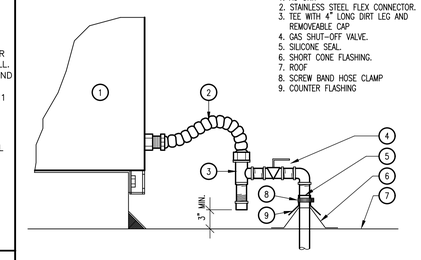
OPERATING WEIGHT: 91 LBS. MAX. NTS



1. TOP OF CONCRETE FLOOR
2. ROUND ADJUSTABLE CAST IRON TOP, TRACTOR COVER. SET TOP FLUSH WITH FINISHED FLOOR.
3. CAULK JOINT WITH LEAD NO WATER TO STAND ON LIP
4. C.I. 1/8 BEND
5. C.I. DRAIN LINE

5 P11 FLOOR CLEANOUT (FCO)

NTS

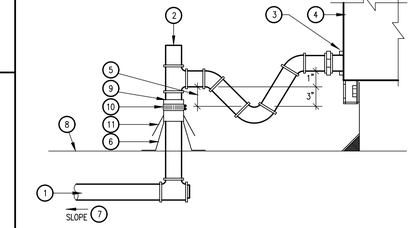


1. AC UNIT
2. STAINLESS STEEL FLEX CONNECTOR.
3. TEE WITH 4" LONG DIRT LEG AND REMOVABLE CAP
4. GAS SHUT–OFF VALVE.
5. SILICONE SEAL.
6. SHORT CONE FLASHING.
7. ROOF
8. SCREW BAND HOSE CLAMP
9. COUNTER FLASHING

6 P11 MECH. UNIT GAS CONNECTION

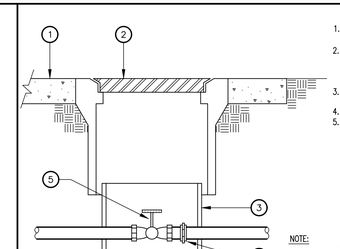
NTS

1. SEE PLAN FOR CONTINUATION
2. OPEN NIPPLE SHALL TERMINATE 1/2" BELOW FLOOD RIM OF INTEGRAL DRAIN PAN IN MECHANICAL UNIT.
3. CONNECTION TO DRAIN STUB. NEOPRENE COVERED HOSE AT UNITS MOUNTED ON VIBRATION ISOLATORS NIPPLES & UNION AT ALL OTHERS
4. MECH. EQUIPMENT CASING
5. DEEP TRAP SEAL. MAKE–UP TRAP OUT OF NIPPLES AND FITTINGS. DELETE IF UNIT IS EQUIPPED WITH AN INTERNAL TRAP.
6. FLASHING.
7. SLOPE HORIZONTAL LINES 1/8" PER FOOT (MIN) PLUG TEE (CO) AT EACH CHANGE OF DIRECTION
8. ROOF.
9. SILICONE SEAL.
10. SCREW BAND HOSE CLAMP.
11. COUNTER FLASHING.



7 P11 CONDENSATE/DRAIN CONNECTION

NTS

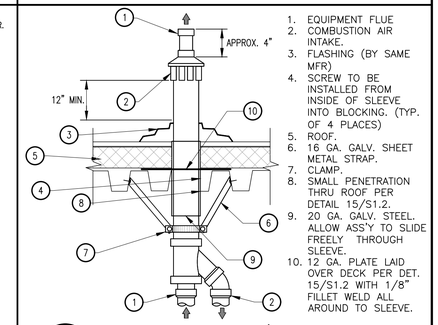


1. FINISHED FLOOR OR SIDEWALK
2. PRE–CAST CONCRETE BOX WITH CAST IRON COVER. LABEL THE COVER "WATER".
3. VIT CLAY OR PVC EXTENSION SLEEVE
4. UNION
5. FULL PORT BALL VALVE WITH ROUND HANDLE OR "C" HANDLE.

NOTE:
VALVE SHALL BE OPERATED IN FULL OPEN POSITION. DO NOT USE FOR THROTTLING.

1 P11 WATER SHUTOFF

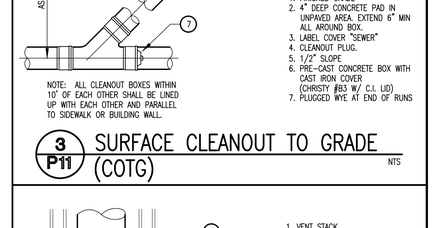
NTS



1. EQUIPMENT FLUE
2. COMBUSTION AIR INTAKE.
3. FLASHING (BY SAME MFR)
4. SCREW TO BE INSTALLED FROM INSIDE OF SLEEVE INTO BLOCKING. (TYP. OF 4 PLACES)
5. ROOF.
6. 16 GA. GALV. SHEET METAL STRAP.
7. CLAMP.
8. SMALL PENETRATION THRU ROOF PER DETAIL 15/S1.2.
9. 20 GA. GALV. STEEL. ALLOW ASS'Y TO SLIDE FREELY THROUGH SLEEVE.
10. 12 GA. PLATE LAID OVER DECK PER DET. 15/S1.2 WITH 1/8" FILLET WELD ALL AROUND TO SLEEVE.

2 P11 CONCENTRIC FLUE/ COMB. AIR THRU ROOF TERMINATION

NTS

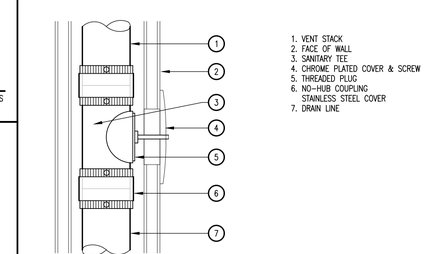


1. FINISHED GRADE
2. 4" DEEP CONCRETE PAD IN UNPAVED AREA. EXTEND 6" MIN ALL AROUND BOX.
3. LABEL COVER "SEWER"
4. CLEANOUT PLUG.
5. 1/2" SLOPE
6. PRE–CAST CONCRETE BOX WITH CAST IRON COVER (CHRISTY #B3 W/ C.I. LID)
7. PLUGGED WYE AT END OF RUNS

NOTE: ALL CLEANOUT BOXES WITHIN 10' OF EACH OTHER SHALL BE LINED UP WITH EACH OTHER AND PARALLEL TO SIDEWALK OR BUILDING WALL.

3 P11 SURFACE CLEANOUT TO GRADE (COTG)

NTS



1. VENT STACK
2. FACE OF WALL
3. SANITARY TEE
4. CHROME PLATED COVER & SCREW
5. THREADED PLUG
6. NO–HUB COUPLING STAINLESS STEEL COVER
7. DRAIN LINE

4 P11 WALL CLEANOUT

NTS

SIMPBK
7790 NORTH PALM AVENUE
FRESNO, CALIFORNIA 93711
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PROJECT:

SHIELDS & BRAWLEY ELEMENTARY SCHOOL

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02-116800

JOHN H. SMITH, A.I.A. C15885
LICENSED ARCHITECT JOHN HAMILTON SMITH C 15885 9-30- RENEWAL DATE STATE OF CALIFORNIA

PROJECT DEVELOPMENT

DATE	ISSUED FOR

REVISIONS

No.	DATE	DESCRIPTION
3	5.19.23	ADDENDUM 3
5	5.26.23	ADDENDUM 5

SHEET DESCRIPTION

PLUMBING DETAILS

REGISTERED PROFESSIONAL ENGINEER GAREN M. LENGIAN NO. 19011 REN. 6-30-24 MECHANICAL STATE OF CALIFORNIA

LEAF ENGINEERS
A PBK COMPANY
895 W. Ashlan Ave, Suite 101 Clovis, CA 93612
p 559-223-9600 www.LEAFengineers.com
job #: 18-1024

PROJECT COORDINATOR	JOHN SMITH
PROJECT NO.	17–67
DATE	3.30.23
SCALE	NTS
SHEET No.	P11

PLUMBING FIXTURE SCHEDULE

MARK	FIXTURE	S or W	V	CW	HW	DESCRIPTION
WC 1	WATER CLOSET	3"	2"	1-1/2"	---	ZURN Z5655-BWL1 ELONGATED FLOOR MOUNTED WITH ZURN Z6200-HET-YB-YC MANUAL FLUSH VALVE WITH METAL COVER AND Z5955SS-EL OPEN-FRONT SEAT. 1.1 GPF. CBC FOR SMALL CHILDREN.
WC 2	WATER CLOSET	3"	2"	1-1/2"	---	ZURN Z5665-BWL1 HET ELONGATED FLOOR MOUNTED WITH ZURN Z6200-HET-YB-YC MANUAL FLUSH VALVE WITH METAL COVER AND Z5955SS-EL OPEN-FRONT SEAT. THE FLUSH HANDLE TO BE MOUNTED ON WIDE SIDE OF STALL, 1.28 GPF. CBC COMPLIANT.
U 1	URINAL	2"	1-1/2"	1"	---	ZURN Z5755 WALL-HUNG FLUSH RIM, 3/4" TOP SPUD, ZURN Z6203-ULF-YB-YC MANUAL FLUSH VALVE, AND MOUNTED WITH BACKING PLATE PER DETAIL 4 & 5/P11A. SEE ARCH. SHEETS FOR MTG. HEIGHT. 1/8 GPF.
U 2	URINAL	2"	1-1/2"	1"	---	ZURN Z5755 WALL-HUNG FLUSH RIM, 3/4" TOP SPUD, ZURN Z6203-ULF-YB-YC MANUAL FLUSH VALVE, AND MOUNTED WITH BACKING PLATE PER DETAIL 4 & 5/P11A. URINAL SHALL EXTEND MIN. OF 14" FROM WALL. SEE ARCH. SHEETS FOR MTG. HEIGHT. CBC COMPLIANT. 1/8 GPF.
L 1	LAVATORY	2"	1-1/2"	1/2"	---	ZURN Z5364 WALL-HUNG, 20"X18" VITREOUS CHINA WITH BACKSPLASH & WALL BRACKET, SINGLE HOLE PUNCH, ZURN Z86300-XL-CP4 METERING FAUCET WITH 0.35 GPM FLOW RESTRICTOR. GRID DRAIN, P-TRAP, SPEEDWAY COMPRESSION WALL STOP & SUPPLY TUBING. MOUNTED WITH BACKING PLATE PER DETAIL 4 & 6/P11A. SEE ARCH. SHEETS FOR MOUNTING HEIGHT. CBC COMPLIANT.
L 2	LAVATORY	2"	1-1/2"	1/2"	1/2"	ZURN Z5114, COUNTERTOP LAVATORY, 20"X17"X6", HOLES ON 4" CENTERS ZURN Z86500-XL-CP4 METERING FAUCET WITH 0.35 GPM FLOW RESTRICTOR. PERFORATED GRID DRAIN, P-TRAP, SPEEDWAY COMPRESSION WALL STOP & SUPPLY TUBING. CBC COMPLIANT.
L 3	LAVATORY	2"	1-1/2"	1/2"	1/2"	ZURN Z5364, WALL-HUNG, 20"x18" VITREOUS CHINA WITH BACKSPLASH & WALL BRACKET, HOLES ON 4" CENTERS ZURN Z86500-XL-CP4 METERING FAUCET WITH 0.35 GPM FLOW RESTRICTOR. , PERFORATED GRID DRAIN, P-TRAP, SPEEDWAY COMPRESSION WALL STOP & SUPPLY TUBING. MOUNTED WITH BACKING PLATE PER DETAIL 4 & 6/P11A. SEE ARCH. SHEETS FOR MOUNTING HEIGHT. CBC COMPLIANT.
L 4	LAVATORY	2"	1-1/2"	1/2"	1/2"	ZURN Z5364 WALL-HUNG, 20"X18" VITREOUS CHINA WITH BACKSPLASH & WALL BRACKET, HOLES ON 4" CENTERS, ZURN Z86500-XL-CP4 METERING FAUCET WITH 0.35 GPM FLOW RESTRICTOR. FLOOR MOUNTED CARRIER JAY. R SMITH 0700. ADJUSTED TO STAY OPEN 10 SECONDS WITH (0.35 GPM) FLOW RESTRICTOR, PERFORATED GRID DRAIN, P-TRAP, SPEEDWAY COMPRESSION WALL STOP & SUPPLY TUBING. MOUNTED WITH BACKING PLATE PER DETAIL 4 & 6/P11A. SEE ARCH. SHEETS FOR MOUNTING HEIGHT. CBC COMPLIANT.
WHA 1	WATER HAMMER ARRESTER	---	---	VARIES	VARIES	SIOUX CHIEF 650 SERIES HYDRA-RESTER, SEAMLESS COPPER CHAMBER SUITABLE FOR CONCEALED INSTALLATION, PDI SIZE INDICATED ON PLANS. INSTALL PER MANUFACTURER RECOMMENDATION.
TP 1	TRAP PRIMER	---	---	1/2"	---	PRECISION PLUMBING PRODUCTS INC. P1-500 TRAP PRIMER VALVE WITH DISTRIBUTION UNIT AND INTEGRAL VACUUM BREAKER. PROVIDE INLET BALL VALVE & ACCESS PANEL. SEE PLANS FOR NO. OF TRAPS SERVED (4 MAX.)
FD 1	FLOOR DRAIN	2"	1-1/2"	TP	---	ZURN Z415-5B COATED CAST IRON WITH 5" ROUND CHROME PLATED GRATE. DOUBLE DRAINAGE FLANGE & NO HUB OUTLET. TRAP PRIMER CONNECTION. GRATE OPENING NOT MORE THAN 1/4".
FD 2	CAN WASH FLOOR DRAIN	3"	2"	1/2"	1/2"	ZURN Z1982-WB-31, 12"X12"X8" ALL TYPE 304 STAINLESS STEEL CAN WASH DRAIN WITH LOOSE SET GRATE AND SEDIMENT BUCKET INCLUDING S.S. MESH LINER. DRAIN HAS INTEGRAL SPRAY NOZZLE OUT CENTER OF GRATE. PROVIDE WITH ZS1464 TYPE 304 S.S. WATER SUPPLY CONTROL BOX WITH INTERNAL MIXING VALVE AND LOCKING BOX.
HB 1	HOSE BIBB	---	---	3/4"	---	BRASS FAUCET, SHIELDED LOOSE KEY HANDLE, NON REMOVABLE VACUUM BREAKER, & ROUGH CHROME FINISH FOR OUTDOORS; POLISHED CHROME INDOORS. WOODFORD 24P-3/4 WITH WALL FLANGE AT WALLS; WOODFORD Y24 AT STAND PIPES.
FS 1	FLOOR SINK	2"	1-1/2"	TP	---	ZURN Z-1901 COATED CAST IRON WITH ACID RESISTANT PAINTED INTERIOR, 12" SQUARE TOP, 8" DEEP, DOUBLE DRAINAGE. NO HUB OUTLET & DOME STRAINER, TRAP PRIMER CONNECTION, 1/2 GRATE.
FS 2	FLOOR SINK	2"	1-1/2"	TP	---	ZURN Z1910-KC-32-19 COATED CAST IRON WITH ACID RESISTANT PAINTED INTERIOR, 8" SQUARE TOP, 6" DEEP, DOUBLE DRAINAGE. NO HUB OUTLET & DOME STRAINER, TRAP PRIMER CONNECTION, 1/2 GRATE.
S 1	SINK	2"	1-1/2"	1/2"	---	JUST CRA-ADA-1931-A-GR, STAINLESS STEEL, SINGLE COMPARTMENT, 16"X22"X6-1/2", CHICAGO 350-GN8AE35ABCP-VPC FAUCET, HAWS 5017LF PUSH BUTTON BUBBLER AND JUST J-35-FS PERFORATED GRID DRAIN, SPEEDWAY COMPRESSION, P-TRAP. WALL STOPS AND SUPPLY TUBING. CBC COMPLIANT.
S 2	SINK	2"	1-1/2"	1/2"	1/2"	JUST DL-ADA-2233-A-GR, 22"X33"X6-1/2", DOUBLE COMPARTMENT, STAINLESS STEEL, WITH HOLES PUNCH. TWO J-35GS BASKET STRAINER AND CHICAGO FAUCETS 2300-8E34VPABCP-VPC SINGLE LEVER FAUCET, P-TRAP. WALL ANGLE STOPS AND SUPPLY TUBING. CBC COMPLIANT.
S 4	SINK	2"	1-1/2"	1/2"	1/2"	JUST SL-ADA-1921-GR, 18 GA STAINLESS STEEL, SINGLE COMPARTMENT, 14"x18"x6-1/2" 1-HOLE PUNCH WITH CHICAGO 50-E35VPABCP-VPC GOOSENECK FAUCET WITH #369 HANDLE J-35-FS PERFORATED GRID DRAIN, SPEEDWAY COMPRESSION WALL STOPS & SUPPLY, P-TRAP. CBC COMPLIANT.
S 5	SINK	2"	1-1/2"	1/2"	1/2"	JUST CRA-ADA-1931-A-GR, STAINLESS STEEL, SINGLE COMPARTMENT, 16"X22"X6-1/2", CHICAGO 50-E35VPABCP-VPC FAUCET, HAWS 5017LF PUSH BUTTON BUBBLER AND JUST J-35-FS PERFORATED GRID DRAIN, SPEEDWAY COMPRESSION, P-TRAP. WALL STOPS AND SUPPLY TUBING. CBC COMPLIANT.
GD 1	GARBAGE DISPOSAL	---	---	---	---	IN-SINK-ERATOR EVOLUTION GARBAGE DISPOSER, 3/4 HP. 120 VOLTS, 8.1 AMPS, AUTOMATIC REVERSING MOTOR, QUICK LOCK MOUNTING.
MV 1	MIXING VALVE	---	---	1/2"	1/2"	BRADLEY S59-4000 POINT OF USE MIXING VALVE, INLINE CHECK VALVES. ADJUSTABLE SET POINT TEMPERATURE CONTROL, SET OUTLET TEMPERATURE AT 108°F. 0.35 GPM MINIMUM FLOW.
SB 1	SUPPLY BOX	---	---	1/2"	---	SPECIAL PRODUCTS #OB-504 RECESSCED METAL WATER SUPPLY BOX WITH SHUT-OFF VALVE.
MS 1	MOP SINK	3"	1 1/2"	3/4"	3/4"	COMMERCIAL ENAMELING CO. 871 ENAMELED CAST IRON CORNER FLOOR MOUNTED WITH C.E.C.O. B-872 REMOVABLE RIM GUARD, CHICAGO FAUCETS 897-CP FAUCET WITH HOSE END, BUCKET HOOK, VACUUM BREAKER. INTEGRAL SHANK STOPS AND WALL BRACE. PROVIDE WITH 5'-0" HOSE.

PLUMBING FIXTURE SCHEDULE

MARK	FIXTURE	S or W	V	CW	HW	DESCRIPTION
DF 1	DRINKING FOUNTAIN	2"	1 1/2"	1/2"	---	ELKAY LK4430BF1U PEDISTAL MOUNTED TRI-LEVEL HEAVY DUTY 316 STAINLESS STEEL OUTDOOR DRINKING FOUNTAIN WITH PUSH BUTTON BOTTLE FILLER. SELF CLOSING PUSH BUTTON VALVES, SEE ARCH. SHEETS FOR MOUNTING HEIGHT. CBC COMPLIANT. NSF APPROVED. COLOR SELECTED BY ARCH. SEE CIVIL DRAWING C5.1 FOR LOCATIONS.
RDF 1	REFFRIG. DRINKING FOUNTAIN	2"	1 1/2"	1/2"	---	ELKAY LZSTL8WSLP WALL-HUNG HIGH-LOW UNIT WITH SENSOR BOTTLE FILLER, FILTER WITH VISUAL FILTER MONITOR, HANGER BRACKET & STAINLESS STEEL RECEPTOR. CAPACITY: 8.0 GPH AT 50°F, 80°F INLET WATER & 90°F AMBIENT AIR, 115/1, 5.5 FLA, SEE ARCH. SHEETS FOR MOUNTING HEIGHT. CBC COMPLIANT FOR ACCESS. STAINLESS STEEL CABINET.
TP 2		---	---	3/4"	---	PRECISION PLUMBING PRODUCTS INC. MODEL "PTS-#OF FD'S SERVED" AUTOMATIC TRAP PRIMER, SET FOR 10 SECONDS EVERY 24 HRS. WITH MANUAL OVERRIDE. 120V/ 220V, 3 WIRE CONNECTION. MOUNTED IN RECESSED PANEL WITH CYLINDAR KEY LOCK S.S. DOOR. PROVIDED WITH INLET BALL VALVE.
WS 1	WASH STATION	2"	1-1/2"	3/4"	3/4"	BRADLEY MODEL 6951B-S, 5-STATION WALL MOUNTED STAINLESS STEEL SINK, BRADLEY PUSH BUTTON METERING FAUCETS MODEL 90-75, WALL MOUNTING BRACKETS, 14 GAUGE TYPE 304 STAINLESS STEEL CONSTRUCTION WITH VANDAL RESISTANT REINFORCED STAINLESS STEEL CHANNELS WELDED TO UNDERSIDE, P-TRAP, WALL STOP VALVES. WITH MV-1 FOR EACH FAUCET.
RD 1	COMBO ROOF & OVERFLOW DRAIN	---	---	---	---	ZURN Z164 COMPLETE WITH CAST IRON MEMBRANE CLAMP, CAST IRON DOME GRATES ON ROOF & OVERFLOW DRAIN INLETS, MINIMUM 2" WATER DAM FOR OVERFLOW PIPE. SEE PLUMBING PLAN FOR SIZE.
GI 1	GREASE INTERCEP.	4"	2"	---	---	JENSEN MODEL JP1000EPE-G 1000 GALLON CAPACITY GREASE INTERCEPTOR PRECAST REINFORCED CONCRETE TANK WITH TRAFFIC H-20 RATING WITH MANHOLE RISERS AS NEEDED.
ESB 1	EFFLUENT SAMPLE BOX	4"	---	---	---	JENSEN MODEL 2432-Z EFFLUENT SAMPLE BOX WITH PIPE CONNECTORS 24"ø GAS TIGHT MAN HOLE COVERS BROUGHT TO GRADE.
SS 1	SERVICE SINK	3"	1-1/2"	1/2"	1/2"	ZURN Z5888, ENAMELED CAST IRON 22"X18"X12-1/2" ACID RESISTING SERVICE SINK, WITH Z5900-IP3 PEDESTAL-TRAP & CLEANOUT, RIM GUARD AND WALL HANGER, CHICAGO 897 FAUCET. PROVIDE STRAINER.
WH 1	WATER HEATER	---	---	1"	1"	RHEEM GHE100, 100 GALLON S.S. TANK, GAS FIRED DIRECT VENT, ULTRA LOW NOX, 130,000 BTUH, 191 GAL/ HR AT 80°F TEMP. RISE. WATTS 40XL, TEMPERATURE PRESSURE RELIEF VALVE. OPERATING WEIGHT = 1600 LBS., C.E.C. APPROVED. 98% THERMAL EFF. PROVIDE WITH CPVC CONCENTRIC VENT. 120 VOLT SERVICE REQUIRED.
WH 2	WATER HEATER	---	---	3/4"	3/4"	RHEEM EGSP 6, 6 GALLON STORAGE CAPACITY, 8 GPH RECOVERY RATE AT 80°F TEMP. RISE WITH 1500 WATT, 7.2 AMPS, 208/1 PHASE ELEMENT, AND 3/4" P&T RELIEF VALVE. OPERATING WEIGHT 91 LBS. C.E.C. APPROVED. MIN. ENERGY FACTOR SHALL BE 0.92.
WH 3	WATER HEATER	---	---	3/4"	3/4"	RHEEM EGSP 20, 20 GALLON STORAGE CAPACITY, 15 GPH RECOVERY RATE AT 80°F TEMP. RISE WITH 3000 WATT, 14.4 AMPS, 208/1 PHASE ELEMENT, AND 3/4" P&T RELIEF VALVE. OPERATING WEIGHT = 243 LBS., C.E.C. APPROVED. MIN. ENERGY FACTOR SHALL BE 0.92.
CP 1	CIRCULATION PUMP	---	---	---	---	PIPE MOUNTED CIRCULATOR WITH CERAMIC SHAFT FOR 5 GPM AT 8' TDH, 115/1. TACO SMART PLUS 008 WITH INTEGRAL FLOW CHECK, REMOTE SENSOR.

NOTES:
1. ALL PLUMBING FIXTURES, FLUSH VALVES, FAUCETS, SHOWER CONTROLS, FLOOR DRAINS, FLOOR SINKS, DRINKING FOUNTAINS, ETC. SHALL BE VANDAL RESISTANT.
2. PLUMBING FIXTURES AND PIPING SHALL COMPLY WITH AB1953 FOR LEAD CONTENT.
3. ALL ACCESS PANELS SHALL HAVE CYLINDER KEY LOCK.

GREASE INTERCEPTOR SIZING (WASTE FIXTURE UNITS)

NO. OF FIX.	TYPE OF FIXTURE	F.U. / FIX	TOTAL FIX UNITS
1	3 COMPARTMENT SINK (KITCHEN)	6.0	6.0
2	HAND WASH SINK (KITCHEN)	1.0	2.0
2	FLOOR SINK	3.0	6.0
5	FLOOR DRAIN	2.0	10.0
1	PREP SINK	3.0	3.0
		TOTAL	27.0

GREASE INTERECPTOR SIZE MINIMUM IS 1000 GALLONS PER UPC 2016 TABLE 1014.3.6.

H.W. DEMAND - MPR

ITEM	QTY.	GPH	TOTAL GPH
LAVATORY/HAND SINK	9	5.0	45.0
SINK	1	20.0	20.0
DISHWASHER (DOMESTIC)	1	15.0	15.0
3-COMP SINK	1	90.0	90.0
DISHWASHER (COMMERCIAL)	1	50.0	50.0
MOP SINK	1	20.0	20.0
WASH STATION	2	25.0	50.0
TOTAL GPH			290.0
MAXIMUM DEMAND			290.0
MAXIMUM DEMAND FACTOR (%) X MAX. DEMAND (GPH)		30	87.0
MAXIMUM STORAGE FACTOR (%) X		1.0	87.0
WATER HEATER TO MEET GPH @ 80° TEMP RISE			87.0
WATER HEATER(S) STORAGE GALLONS			90.0

WATER BOOSTER PUMP SCHEDULE

NUMBER	WBP-1
TYPE	CENTRIFUGAL
MOUNTING	VERTICAL
HP / BHP	3 / -
VOLTS / PHASE	460 / 3
MOTOR FLA	2.6
RPM / EFF. (%)	3450 / -
# OF PUMPS	2
GPM / TDH (FT. WC.)	68 / 92.6
INLET/OUTLET (IN.)	1-1/2 / 1
SERVICE	DOMESTIC WATER
OPER. WT. (LBS.)	1850
MANUFACURER	QUANTUMFLO
MODEL	PRODIGY 2

NOTES:
1. PROVIDE NEMA 3R CONTROL PANEL, VFD CONTROLLER, 304 STAINLESS STEEL FRAME. BACNET. PROVIDE BY-PASS ASSEMBLY WITH CHECK VALVE, VIBRATION ISOLATION KIT.
2. MEET NSF 61 & NSF 372.
3.

DOMESTIC WATER DEMAND AND PIPE SIZING

PLAN CHECK# DATE: 1/22/19 PREPARED BY: K.R.L.
PROJECT: SHIELDS & BRAWLEY ELEM. SCHOOL LOCATION: FRESNO, CA
Water Meter Size 4"
Total Fixture Units: 418.0 TOTAL GPM: 129
Total Distance from water meter to most remote plbg. fixture. 1000 ft.
Total rise for head loss 20 ft. x 0.43 . . . . . 8.6 PSI
PSI required for water closet/urinal
(*F.V.=25.0 PSI, F.T.=8.0 PSI) . . . . . 15.0 PSI
PSI flow loss through water meter (Chart A-1) . . . . . 1.7 PSI
PSI flow loss through backflow preventer
(RP=12.0 PSI, D.C.=12.0 PSI) . . . . . 12.0 PSI
Total system loss . . . . . 37.3 PSI
MINIMUM PSI available @ jobsite . . . . . 35.0 PSI
Total system loss in PSI . . . . . -2.3 PSI
Remaining PSI available (if negative use booster pump) . . . . -2.3 PSI
Booster pump PSI . . . . . 35.0 PSI
Total remaining PSI available . . . . . 32.7 PSI
PSI available 32.7 / 1000 Total Feet = .041 x 100 = 4.1 PSI/100 FT
Use line 4.1 On Chart
VELOCITIES SHALL NOT EXCEED 8 FT/SEC.

PIPE SIZE (IN.)	WILL DELIVER (GPM)	FOR F.V. (F.U.)	FOR FT (F.U.)
6"			
5"			
4"			
3"	180	450	450
2-1/2"	110	305	429
2"	68	104	214
1-1/2"	33	18	60
1-1/4"	23	6	37
1"	12	---	15
3/4"	6	---	8
1/2"	3	---	3

F.V. = Flushometer Valve
F.T. = Flush Tank
CPC 2016, APPENDIX A

FIXTURE UNIT (COLD WATER)

NO. OF FIX.	TYPE OF FIXTURE	F.U. / FIX.	TOTAL FIX. UNITS
---	BATHTUB	4.0	---
---	CLOTHESWASHER	4.0	---
---	DISH WASHER (COMM.)	1.5	---
7	DRINKING FOUNTAIN (2) BUBBLER	0.5	3.5
1	HOSE BIBB	2.5	2.5
33	HOSE BIBB (EA. ADDITION)	1.0	33.0
41	CLASSROOM SINK	1.5	61.5
1	KITCHEN SINK 3- COMP. (POT)	2.5	2.5
---	LAUNDRY SINK	1.5	---
38	LAVATORY	1.0	38.0
1	MOP SINK	3.0	3.0
2	SERVICE SINK	3.0	6.0
---	SHOWER	2.0	---
2	SINK	2.0	4.0
8	URINAL	4.0	32.0
1	WASHFOUNTAIN	4.0	4.0
---	WATER CLOSET (F. TANK)	2.5	---
37	WATER CLOSET (F. VALVE)	5.0	185.0
1	FUTURE	20.0	20.0
		TOTAL	395.0

PER CPC 2016, TABLE A-103.1, APPX, A

SIMPBK
7790 NORTH PALM AVENUE
FRESNO, CALIFORNIA 93711
T559.448.8400 · F559.448.8467
www.sim-pbk.com

PROJECT:
SHIELDS & BRAWLEY ELEMENTARY SCHOOL

CENTRAL UNIFIED SCHOOL DISTRICT — Every Day!

AD 5-37a
S&B Elementary
02-116800

JOHN H. SMITH, A.I.A. C15885
LICENSED ARCHITECT JOHN HAMILTON SMITH C 15885 9-30- RENEWAL DATE STATE OF CALIFORNIA

PROJECT DEVELOPMENT

DATE	ISSUED FOR

REVISIONS

No.	DATE	DESCRIPTION
3	5.19.23	ADDENDUM 3
5	5.26.23	ADDENDUM 5

SHEET DESCRIPTION

PLUMBING SCHEDULES

REGISTERED PROFESSIONAL ENGINEER GAREN M. LENGOMIN NO. 19011 REN. 6/30/24 FIRE PROTECTION STATE OF CALIFORNIA

LEAF ENGINEERS
A PBK COMPANY
895 W. Ashlan Ave, Suite 101 Clovis, CA 93612
p 559-223-9600 www.LEAFengineers.com
job #: 18-1024

PROJECT COORDINATOR	JOHN SMITH
PROJECT NO.	17-67
DATE	3.30.23
SCALE	NTS
SHEET No.	P12

AD 5-38a
S&B Elemenatary
02-116800

LP Engineers, Inc.

FRESNO HIGH SCHOOL CTE

1839 N. ECHO AVENUE

FRESNO, CALIFORNIA

DSA APPL. # 02-117712

FIRE SPRINKLER MATERIAL DATA

5

SCHEDULE 10 & 40

Always ready to protect your most valuable assets.

As the leading supplier of steel sprinkler pipe, we understand that there are no second chances in fire suppression. You need products of enduring quality and exceptional strength–plus reliable service. You need Bull Moose.

Bull Moose Fire Sprinkler Pipe Product Information

	Nominal Pipe Size (Inches)	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"	6"	8"
SCHEDULE 10	O.D. (in)	1.315	1.660	1.900	2.375	2.875	3.500	4.500	6.625	8.625
	I.D. (in)	1.097	1.442	1.682	2.157	2.635	3.260	4.260	6.357	8.249
	Empty Weight (lb/ft)	1.410	1.810	2.090	2.640	3.530	4.340	5.620	9.290	16.940
	Water Filled Weight (lb/ft)	1.820	2.518	3.053	4.223	5.893	7.957	11.796	23.038	40.086
	C.R.R.	15.27	9.91	7.76	6.27	4.92	3.54	2.50	1.158	1.805
	Pieces per Lift	91	61	61	37	30	19	19	10	7
	Lift Weight (lbs) 21' lengths	2,695	2,319	2,677	2,051	2,224	1,732	2,242	1,951	2,490
	Lift Weight (lbs) 24' lengths	3,079	2,650	3,060	2,344	2,542	1,979	2,563	2,230	2,848
	Lift Weight (lbs) 25' lengths	3,208	2,760	3,187	2,442	2,648	2,062	2,670		

	NPS (In.)	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"
SCHEDULE 40		1.315	1.660	1.900	2.375	2.875	3.500	4.500
		1.049	1.380	1.610	2.067	2.469	3.068	4.026
		1.680	2.270	2.720	3.660	5.800	7.580	10.800
		2.055	2.918	3.602	5.114	7.875	10.783	16.316
		1.00	1.00	1.00	1.00	1.00	1.00	1.00
		70	51	44	30	30	19	19
		2,470	2,431	2,513	2,306	3,654	3,024	4,309
		2,822	2,778	2,872	2,635	4,176	3,456	4,925
		2,940	2,894	2,992	2,745	4,350	3,601	5,130

SCHEDULE 10 & 40 ADVANTAGES:

- UL listed (US & Canada) and FM approved
- ASTM A135 and A795 Type E, Grade A Certified
- Complies with NFPA-13, 13R and 14
- Industry-leading hydraulic characteristics
- CRR of 1.0 and greater
- All pipe NDT weld tested

OTHER BENEFITS/SERVICES:

- We have the most stocking locations in the industry, for best delivery and availability
- Plain end or roll groove
- Eddy Guard II™ bacterial-resistant internal coating
- Custom length options
- Hot dipped galvanization
- Reddi-Pipe® red or black pipe eliminates field painting
- Compatible for use in wet, dry, preaction and deluge sprinkler systems
- The only maker with EPDs (to help earn LEED points).

Exclusive maker of Reddi-Pipe®
RED OR BLACK PAINTED PIPE.

CERTIFIED ENVIRONMENTAL PRODUCT DECLARATION UL.COM/EPD

c UL us LISTED

FM APPROVED

NFPA

AFSA American Fire Sprinkler Association

NFSA The Voice of the Fire Sprinkler Industry

BULL MOOSE TUBE

800.325.4467
sales@BullMooseIndustries.com
BullMooseTube.com

This packet contains engineering and product information specific to the following project:

Project Info

Project Name: Voorhies

Project Address: 6001 Pioneer Drive

Architect:

Engineer:

Contractor:

Submittal Date: 3/10/2017

Approver Instructions

Review product specifications: Please review the product specifications and technical information for each product to ensure suitability of application and use.

Review product options: If applicable, please review the selected product options on each product page to ensure suitability of application and use.

Approve or reject individual products: Please complete the approval stamp section for each product.

OPTIONAL STAINLESS STEEL BOLTS & NUTS:
Stainless steel bolts and nuts are also available. Contact a Gruvlok Representative for more information.

HOUSING:
Ductile Iron conforming to ASTM A536, Grade 65-45-12, or
Malleable Iron conforming to ASTM A47, Grade 32510.

OPTIONAL COATINGS:

- ❑ Rust inhibiting lead-free paint Color: ORANGE (standard)
- ❑ Hot Dipped Zinc Galvanized (optional)
- ❑ Other Colors Available (IE: RAL3000 and RAL9000): _____

For other Coating requirements contact a Gruvlok Representative.

Approval Stamp

- ☐ **Approved**
- ☐ **Approved as noted**
- ☐ **Not approved**

Remarks:

Product Index

The following products are included in this submittal:

FIG. 3201

90° Elbow

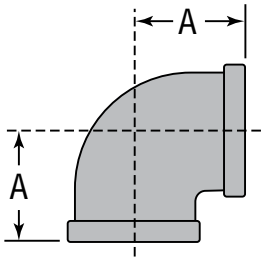

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FIGURE 3201 - 90° ELBOW

Nominal Size	Maximum Working Pressure▲	Dimension A	Approx. Wt. Each
In. (mm)	*PSI (kPa)*	*In. (mm)*	*Lbs. (kg)*
1 *20*	500 *3450*	1.50 *38.10*	0.62 *0.28*
1¼ *32*	500 *3450*	1.75 *44.45*	0.90 *0.41*
1½ *40*	500 *3450*	1.94 *49.276*	1.20 *0.54*
2 *50*	500 *3450*	2.25 *57.15*	1.85 *0.84*

▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit anvilintl.com or contact your local Anvil Representative.

MATERIAL SPECIFICATIONS

Dimensions: ASME B16.3

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

NOTICE: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

PROJECT INFORMATION	APPROVAL STAMP
Project: Voorhies	☐ **Approved**
Address: 6001 Pioneer Drive	☐ **Approved as noted**
Contractor: Phone:	☐ **Not approved**
Engineer: Phone:	**Remarks:**
Submittal Date: 3/10/2017	
Notes 1: Threaded Fittings	
Notes 2:	

FIG. 3202

45° Elbow

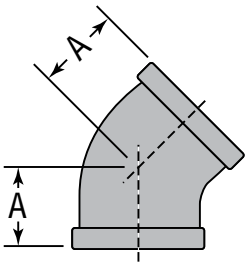

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FIGURE 3202 - 45° ELBOW

Nominal Size	Maximum Working Pressure▲	Dimension A	Approx. Wt. Each
In. (mm)	*PSI (kPa)*	*In. (mm)*	*Lbs. (kg)*
1 *25*	500 *3450*	1.12 *28.44*	0.46 *0.21*
1¼ *32*	500 *3450*	1.29 *32.76*	0.73 *0.33*
1½ *40*	500 *3450*	1.43 *36.32*	0.92 *0.42*
2 *50*	500 *3450*	1.68 *42.67*	1.50 *0.68*

▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit anvilintl.com or contact your local Anvil Representative.

MATERIAL SPECIFICATIONS

Dimensions: ASME B16.3

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

NOTICE: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

PROJECT INFORMATION	APPROVAL STAMP
Project: Voorhies	☐ **Approved**
Address: 6001 Pioneer Drive	☐ **Approved as noted**
Contractor: Phone:	☐ **Not approved**
Engineer: Phone:	**Remarks:**
Submittal Date: 3/10/2017	
Notes 1: Threaded Fittings	
Notes 2:	

FIG. 3205R

Reducing Tee

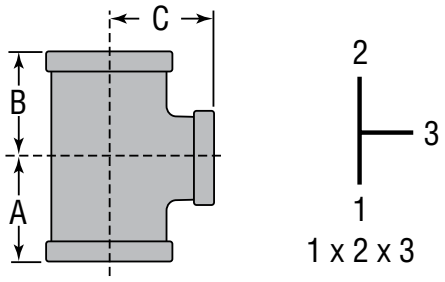

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FIGURE 3205R - REDUCING TEE

Nominal Size 1 x 2 x 3	Max. Working Pressure▲	Dimensions A	Dimensions B	Dimensions C	Approx. Wt. Each
In. (mm)	*PSI (kPa)*	*In. (mm)*	*In. (mm)*	*In. (mm)*	*Lbs. (kg)*
1 x ½ x 1 *25 x 15 x 25*	500 *3450*	1.50 *38.10*	1.36 *34.54*	1.50 *38.10*	0.64 *0.29*
1 x ¾ x 1 *25 x 20 x 25*	500 *3450*	1.50 *38.10*	1.45 *36.83*	1.50 *38.10*	0.73 *0.33*
1 x 1 x ½ *25 x 25 x 15*	500 *3450*	1.26 *32.00*	1.26 *32.00*	1.36 *34.54*	0.71 *0.32*
1 x 1 x ¾ *25 x 25 x 20*	500 *3450*	1.37 *34.80*	1.37 *34.80*	1.45 *36.83*	0.76 *0.34*
1 x 1 x 1¼* *25 x 25 x 32*	500 *3450*	1.67 *42.41*	1.67 *42.41*	1.58 *40.13*	0.98 *0.44*
1 x 1 x 1½* *25 x 25 x 40*	500 *3450*	1.80 *45.72*	1.80 *45.72*	1.65 *41.91*	1.16 *0.53*
1¼ x 1 x ½* *32 x 25 x 15*	500 *3450*	1.34 *34.04*	1.26 *32.00*	1.53 *38.86*	0.82 *0.37*
1¼ x 1 x ¾ *32 x 25 x 20*	500 *3450*	1.45 *36.83*	1.37 *34.80*	1.62 *41.15*	0.90 *0.41*
1¼ x 1 x 1 *32 x 25 x 25*	500 *3450*	1.58 *40.13*	1.50 *38.10*	1.67 *42.42*	1.00 *0.45*
1¼ x 1 x 1¼ *32 x 25 x 32*	500 *3450*	1.75 *44.45*	1.67 *42.42*	1.75 *44.45*	1.08 *0.49*
1¼ x 1 x 1½ *32 x 25 x 40*	500 *3450*	1.88 *47.75*	1.80 *45.72*	1.82 *46.22*	1.42 *0.64*
1¼ x 1¼ x ½ *32 x 32 x 15*	500 *3450*	1.34 *34.04*	1.34 *34.04*	1.53 *38.86*	0.86 *0.39*

MATERIAL SPECIFICATIONS

Dimensions: ASME B16.3

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

NOTICE: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

FIGURE 3205R - REDUCING TEE

Nominal Size 1 x 2 x 3	Max. Working Pressure▲	Dimensions A	Dimensions B	Dimensions C	Approx. Wt. Each
In. (mm)	*PSI (kPa)*	*In. (mm)*	*In. (mm)*	*In. (mm)*	*Lbs. (kg)*
1¼ x 1¼ x ¾ *32 x 32 x 20*	500 *3450*	1.45 *36.83*	1.45 *36.83*	1.62 *41.15*	0.92 *0.42*
1¼ x 1¼ x 1 *32 x 32 x 25*	500 *3450*	1.58 *40.13*	1.58 *40.13*	1.67 *42.42*	0.95 *0.43*
1¼ x 1¼ x 1½* *32 x 32 x 40*	500 *3450*	1.88 *47.75*	1.88 *47.75*	1.82 *46.22*	1.45 *0.66*

▲ Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit anvilintl.com or contact your local Anvil Representative.

* Part supplied as "Bull Head Tee".

PROJECT INFORMATION	APPROVAL STAMP
Project: Voorhies	☐ **Approved**
Address: 6001 Pioneer Drive	☐ **Approved as noted**
Contractor: Phone:	☐ **Not approved**
Engineer: Phone:	**Remarks:**
Submittal Date: 3/10/2017	
Notes 1: Threaded Fittings	
Notes 2:	

FIG. 3205R

Reducing Tee

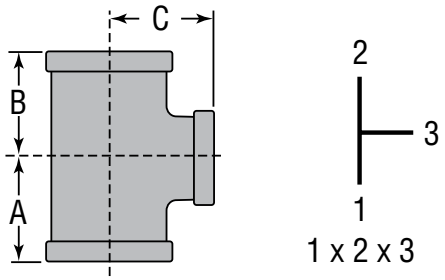

FIGURE 3205R - REDUCING TEE					
Nominal Size	Max. Working Pressure▲	Dimensions			Approx. Wt. Each
1 x 2 x 3		A	B	C	
In. (mm)	*PSI (kPa)*	*In. (mm)*	*In. (mm)*	*In. (mm)*	*Lbs. (kg)*
1¼ x 1¼ x 2* *32 x 32 x 50*	500 *3450*	2.10 *53.34*	2.10 *53.34*	1.90 *48.26*	1.75 *0.79*
1½ x 1 x ½ *40 x 25 x 15*	500 *3450*	1.41 *35.81*	1.34 *34.04*	1.66 *42.16*	0.95 *0.43*
1½ x 1 x ¾ *40 x 25 x 20*	500 *3450*	1.52 *38.61*	1.37 *34.80*	1.75 *44.45*	1.14 *0.52*
1½ x 1 x 1 *40 x 25 x 25*	500 *3450*	1.65 *41.91*	1.50 *38.10*	1.80 *45.72*	1.17 *0.53*
1½ x 1 x 1¼ *40 x 25 x 32*	500 *3450*	1.82 *46.23*	1.67 *42.42*	1.88 *47.75*	1.34 *0.61*
1½ x 1 x 1½ *40 x 25 x 40*	500 *3450*	1.94 *49.28*	1.80 *45.72*	1.94 *49.28*	1.45 *0.66*
1½ x1¼ x ½ *40 x 32 x 15*	500 *3450*	1.41 *35.81*	1.34 *34.04*	1.66 *42.16*	1.05 *0.48*
1½ x1¼ x ¾ *40 x 32 x 20*	500 *3450*	1.52 *38.61*	1.45 *36.83*	1.75 *44.45*	1.15 *0.5*
1½ x 1¼ x 1 *40 x 32 x 25*	500 *3450*	1.65 *41.91*	1.58 *40.13*	1.80 *45.72*	1.25 *0.57*
1½ x 1¼ x 2* *40 x 32 x 50*	500 *3450*	2.16 *54.86*	2.10 *53.34*	2.02 *51.30*	1.90 *0.86*
1½ x 1½ x ½ *40 x 40 x 15*	500 *3450*	1.41 *35.81*	1.41 *35.81*	1.16 *29.46*	1.15 *0.52*
1½ x 1½ x ¾ *40 x 40 x 20*	500 *3450*	1.52 *38.61*	1.52 *38.61*	1.75 *44.45*	1.24 *0.56*
1½ x 1½ x 1 *40 x 40 x 25*	500 *3450*	1.65 *41.91*	1.65 *41.91*	1.80 *45.72*	1.30 *0.59*
1½ x 1½ x 1¼ *40 x 40 x 32*	500 *3450*	1.82 *46.23*	1.82 *46.23*	1.88 *47.75*	1.48 *0.67*

FIGURE 3205R - REDUCING TEE					
Nominal Size	Max. Working Pressure▲	Dimensions			Approx. Wt. Each
1 x 2 x 3		A	B	C	
In. (mm)	*PSI (kPa)*	*In. (mm)*	*In. (mm)*	*In. (mm)*	*Lbs. (kg)*
1½ x 1½ x 2* *40 x 40 x 50*	500 *3450*	2.16 *54.86*	2.16 *54.86*	2.02 *51.30*	1.98 *0.90*
2 x 1 x 2 *50 x 25 x 50*	500 *3450*	2.25 *57.15*	2.02 *51.31*	2.25 *57.15*	2.15 *0.98*
2 x 1¼ x 2 *50 x 32 x 50*	500 *3450*	2.25 *57.15*	2.10 *53.34*	2.25 *57.15*	2.30 *1.04*
2 x 1½ x ½ *50 x 40 x 15*	500 *3450*	1.49 *37.85*	1.41 *35.81*	1.88 *47.75*	1.50 *0.68*
2 x 1½ x ¾ *50 x 40 x 20*	500 *3450*	1.60 *40.64*	1.52 *38.61*	1.97 *50.04*	1.62 *0.73*
2 x 1½ x 1 *50 x 40 x 25*	500 *3450*	1.73 *43.94*	1.65 *41.91*	2.02 *51.31*	1.64 *0.74*
2 x 1½ x 1¼ *50 x 40 x 32*	500 *3450*	1.90 *48.26*	1.82 *46.23*	2.10 *53.34*	1.80 *0.82*
2 x 1½ x 1½ *50 x 40 x 40*	500 *3450*	2.02 *51.31*	1.94 *49.28*	2.16 *54.86*	2.00 *0.91*
2 x 1½ x 2 *50 x 40 x 50*	500 *3450*	2.25 *57.15*	2.16 *54.86*	2.25 *57.15*	2.35 *1.07*
2 x 2 x ½ *50 x 50 x 15*	500 *3450*	1.49 *37.85*	1.49 *37.85*	1.88 *47.75*	1.60 *0.73*
2 x 2 x ¾ *50 x 50 x 20*	500 *3450*	1.60 *40.64*	1.60 *40.64*	1.97 *50.04*	1.68 *0.76*
2 x 2 x 1 *50 x 50 x 25*	500 *3450*	1.73 *43.94*	1.73 *43.94*	2.02 *51.31*	1.85 *0.84*
2 x 2 x 1¼ *50 x 50 x 32*	500 *3450*	1.90 *44.45*	1.90 *42.42*	2.10 *44.45*	2.04 *0.93*
2 x 2 x 1½ *50 x 50 x 40*	500 *3450*	2.02 *44.45*	2.02 *42.42*	2.16 *44.45*	2.18 *0.99*

▲ Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit anvilintl.com or contact your local Anvil Representative.

* Part supplied as "Bull Head Tee".

FIG. 3207

Cross

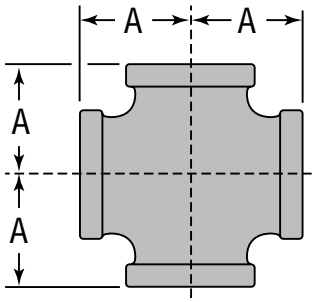

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FIGURE 3207 - CROSS

Nominal Size	Maximum Working Pressure▲	Dimension A	Approx. Wt. Each
In. (mm)	*PSI (kPa)*	*In. (mm)*	*Lbs. (kg)*
1 *25*	500 *3450*	1.50 *38.10*	0.98 *0.44*
1¼ *32*	500 *3450*	1.75 *44.45*	1.50 *0.68*
1½ *40*	500 *3450*	1.94 *49.27*	1.90 *0.86*
2 *50*	500 *3450*	2.25 *57.15*	2.95 *1.34*

▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit anvilintl.com or contact your local Anvil Representative.

MATERIAL SPECIFICATIONS

Dimensions: ASME B16.3

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

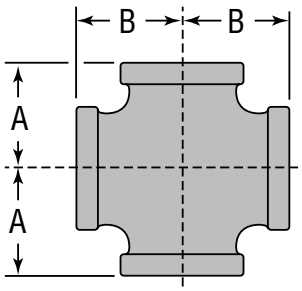
Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

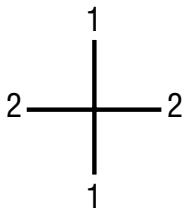
NOTICE: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

PROJECT INFORMATION	APPROVAL STAMP
Project: Voorhies	☐ **Approved**
Address: 6001 Pioneer Drive	☐ **Approved as noted**
Contractor: Phone:	☐ **Not approved**
Engineer: Phone:	**Remarks:**
Submittal Date: 3/10/2017	
Notes 1: Threaded Fittings	
Notes 2:	

FIG. 3207R

Reducing Cross





1 x 1 x 2 x 2

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FIGURE 3207R - REDUCING CROSS

Nominal Size 1 x 1 x 2 x 2	Max. Working Pressure▲	Dimensions		Approx. Wt. Each
		A	B	
In. (mm)	*PSI (kPa)*	*In. (mm)*	*In. (mm)*	*Lbs. (kg)*
1¼ x 1¼ x 1 x 1 *32 x 32 x 25 x 25*	500 *3450*	1.58 *40.13*	1.67 *42.41*	1.27 *0.58*
1½ x 1½ x 1 x 1 *40 x 40 x 25 x 25*	500 *3450*	1.65 *41.91*	1.80 *45.72*	1.48 *0.67*
2 x 2 x 1 x 1 *50 x 50 x 25 x 25*	500 *3450*	1.73 *43.94*	2.02 *51.30*	2.10 *0.95*

▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit anvilintl.com or contact your local Anvil Representative.

MATERIAL SPECIFICATIONS

Dimensions: ASME B16.3

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

NOTICE: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

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Address: 6001 Pioneer Drive	☐ **Approved as noted**
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Engineer: Phone:	**Remarks:**
Submittal Date: 3/10/2017	
Notes 1: Threaded Fittings	
Notes 2:	

FIG. 3221
Coupling

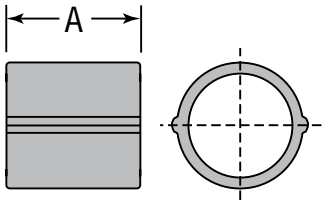

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FIGURE 3221 - COUPLING

Nominal Size	Maximum Working Pressure▲	Dimension A	Approx. Wt. Each
In. (mm)	*PSI (kPa)*	*In. (mm)*	*Lbs. (kg)*
1 *25*	500 *3450*	1.67 *42.42*	0.40 *0.18*
1¼ *32*	500 *3450*	1.93 *49.02*	0.57 *0.26*
1½ *40*	500 *3450*	2.15 *54.61*	0.75 *0.34*
2 *50*	500 *3450*	2.53 *64.26*	1.15 *0.52*

▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit anvilintl.com or contact your local Anvil Representative.

MATERIAL SPECIFICATIONS

Dimensions: ASME B16.3

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

NOTICE: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

PROJECT INFORMATION	APPROVAL STAMP
Project: Voorhies	☐ **Approved**
Address: 6001 Pioneer Drive	☐ **Approved as noted**
Contractor: Phone:	☐ **Not approved**
Engineer: Phone:	**Remarks:**
Submittal Date: 3/10/2017	
Notes 1: Threaded Fittings	
Notes 2:	

FIG. 3221R

Reducing Coupling

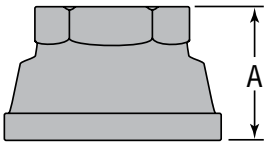

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FIGURE 3221R - REDUCING COUPLING

Nominal Size	Maximum Working Pressure▲	Dimension A	Approx. Wt. Each
In. (mm)	*PSI (kPa)*	*In. (mm)*	*Lbs. (kg)*
1 x ½ *25 x 15*	500 *3450*	1.69 *42.92*	0.39 *0.18*
1 x ¾ *25 x 20*	500 *3450*	1.69 *42.92*	0.53 *0.24*

▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit anvilintl.com or contact your local Anvil Representative.

MATERIAL SPECIFICATIONS

Dimensions: ASME B16.3

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

NOTICE: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

PROJECT INFORMATION	APPROVAL STAMP
Project: Voorhies	☐ **Approved**
Address: 6001 Pioneer Drive	☐ **Approved as noted**
Contractor: Phone:	☐ **Not approved**
Engineer: Phone:	**Remarks:**
Submittal Date: 3/10/2017	
Notes 1: Threaded Fittings	
Notes 2:	

FIG. 3224
Cap

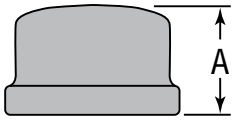

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FIGURE 3224 - CAP

Nominal Size	Maximum Working Pressure▲	Dimension A	Approx. Wt. Each
In. (mm)	*PSI (kPa)*	*In. (mm)*	*Lbs. (kg)*
1 *25*	500 *3450*	1.16 *29.46*	0.32 *0.15*
1¼ *32*	500 *3450*	1.28 *32.51*	0.43 *0.20*
1½ *40*	500 *3450*	1.33 *33.78*	0.60 *0.27*
2 *50*	500 *3450*	1.45 *36.83*	0.91 *0.41*

▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit anvilintl.com or contact your local Anvil Representative.

MATERIAL SPECIFICATIONS

Dimensions: ASME B16.3

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

NOTICE: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

PROJECT INFORMATION	APPROVAL STAMP
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Address: 6001 Pioneer Drive	☐ **Approved as noted**
Contractor: Phone:	☐ **Not approved**
Engineer: Phone:	**Remarks:**
Submittal Date: 3/10/2017	
Notes 1: Threaded Fittings	
Notes 2:	

FIG. 3283
Bushings

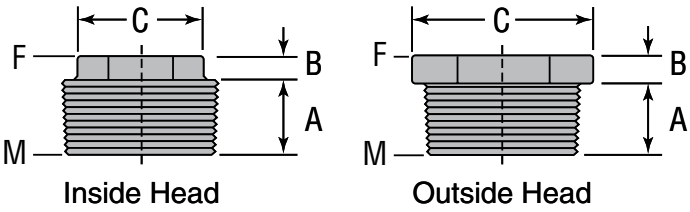

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FIGURE 3283 - BUSHINGS

Nominal Size Male (M) x Female (F)	Max. Working Pressure▲	Dimensions			Style	Approx. Wt. Each
		A	B	C		
In. (mm)	*PSI (kPa)*	*In. (mm)*	*In. (mm)*	*In. (mm)*		*Lbs. (kg)*
1 x ½ *25 x 15*	500 *3450*	0.75 *19.05*	0.25 *6.35*	1.42 *36.06*	Outside	0.22 *0.10*
1 x ¾ *25 x 20*	500 *3450*	0.75 *19.05*	0.25 *6.35*	1.42 *36.06*	Outside	0.17 *0.08*
1¼ x 1 *32 x 25*	500 *3450*	0.80 *20.32*	0.28 *7.11*	1.76 *44.70*	Outside	0.28 *0.13*
1½ x 1 *40 x 25*	500 *3450*	0.83 *21.08*	0.31 *7.874*	2.00 *50.80*	Outside	0.45 *0.20*
1½ x 1¼ *40 x 32*	500 *3450*	0.83 *21.08*	0.31 *7.874*	2.00 *50.80*	Outside	0.30 *0.14*
2 x 1 *50 x 25*	500 *3450*	0.88 *22.35*	0.41 *10.414*	1.95 *49.53*	Inside	0.67 *0.30*
2 x 1¼ *50 x 32*	500 *3450*	0.88 *22.35*	0.34 *8.636*	2.48 *62.99*	Outside	0.73 *0.33*
2 x 1½ *50 x 40*	500 *3450*	0.88 *22.35*	0.34 *8.636*	2.48 *62.99*	Outside	0.61 *0.28*

▲ – Working Pressure Ratings are for reference only and based on Sch. 40 pipe. For the latest UL/ULC, and FM pressure ratings versus pipe schedule, please visit anvilintl.com or contact your local Anvil Representative.

MATERIAL SPECIFICATIONS

Dimensions: ASME B16.14

Material: ASTM A536 Grade 65-45-12

Finish: Black

Threads: NPT per ASME B1.20.1

Agency Approvals: All ductile iron threaded fittings are UL/ULC Listed and FM Approved.

NOTICE: Ductile iron fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns.

PROJECT INFORMATION	APPROVAL STAMP
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Address: 6001 Pioneer Drive	☐ **Approved as noted**
Contractor: Phone:	☐ **Not approved**
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Submittal Date: 3/10/2017	
Notes 1: Threaded Fittings	
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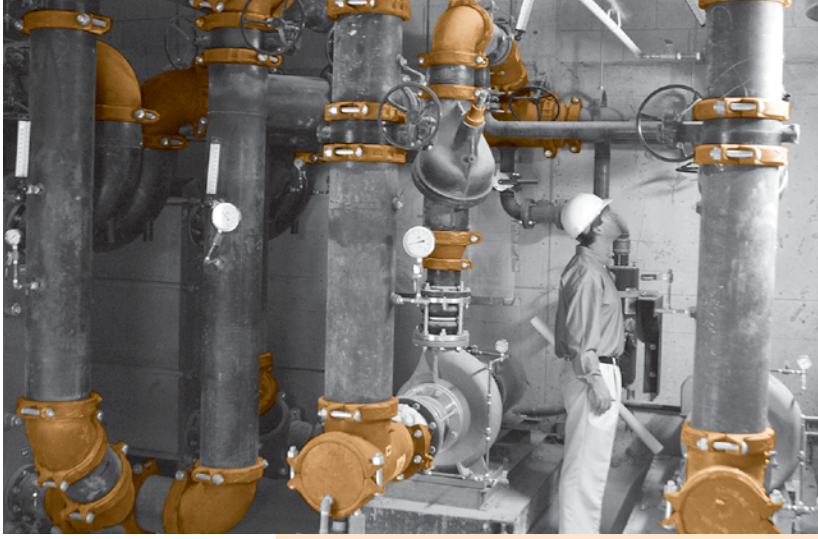


GRUVLOK®

Mechanical Piping Products

Durable. Flexible. Safe. Easy to install. Easy to maintain. That's Anvil's Gruvlok® product line. Gruvlok gives your building the toughest, simplest, and most adaptable piping system possible.

Through a combination of roll-grooving and two-bolt coupling design, this innovative product line joins piping and other components into a single rugged yet flexible system. This makes Gruvlok products ideal for a variety of applications — particularly in tight spaces such as subfloors, UFAD systems, crawlspaces, trenches, and tunnels.

Gruvlok products eliminate the need for traditional expansion joints, allowing your system to expand and contract with your needs. With a Gruvlok union at every joint, you have the freedom to make on-site tweaks without altering the overall design of your system.

Maintenance is as simple and flexible as installation. Every component in a Gruvlok system is easily replaceable and easily accessed, so that you can make repairs without resorting to a total shut-down.

3-D CAD Library

Anvil's Gruvlok product line is now available in 3-D CAD Models, as well as the standard 2-D drawings, at www.anvilintl.com. Anvil also offers downloadable Master Format 3 Part Specifications.

Building Green with Anvil

Anvil manufactures an extensive line of products composed of 90% recycled materials, visit www.anvilintl.com for current certificates related to recycled material. Anvil is a member of the United States Green Building Council.

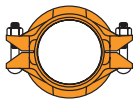
Products include:

- Gruvlok® Couplings, Fittings, and Flanges
- Anvil® Cast and Malleable Threaded Fittings
- Anvil Cast Iron Flanged Fittings
- Anvil Pipe Hangers and Supports
- Merit® Tee-Lets and Drop Nipples
- Beck Welded Pipe Nipples

GRUVLOK® PICTORIAL PARTS INDEX

COUPLINGS

Fig. 7401 *Pages 18-19*
Rigidlok® Coupling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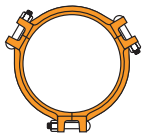
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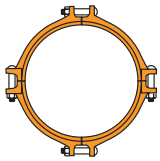

Size Range: 18" - 24"

Fig. 7401-2 *Page 20*
Rigidlok® Coupling
Size Range: 14" - 24"

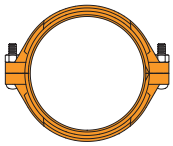


Fig. 74 *Pages 21-22*
SlideLOK® Ready for Installation Coupling
Size Range: 2" - 8"

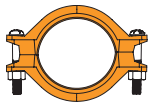
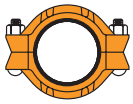
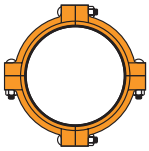


Fig. 7001 *Pages 25-26*
Flexible Coupling


Size Range: 1" - 14"


Size Range: 16" - 24"

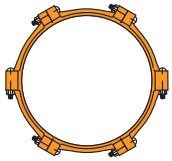

Size Range: 28" - 30 I.D."

Fig. 7402 *Pages 23-24*
SlideLOK® Ready for Installation Coupling
Size Range: 2" - 8"

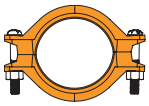


Fig. 7001-2 *Page 27*
Flexible Coupling
Size Range: 14" - 24"

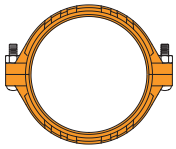


Fig. 7011 *Pages 28-29*
Standard Coupling
Size 30 O.D."

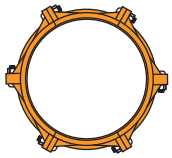


Fig. 7022 *Pages 30-33*
Weld Ring Gruv-Ring Coupling
Size Range: 30" - 60"

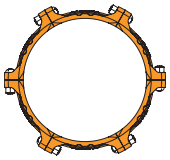


Fig. 7000 *Pages 34-35*
Lightweight Flexible Coupling
Size Range: 1" - 8"

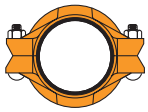


Fig. 7400 *Pages 36-37*
300 PSI Rigidlite® Coupling
Size Range: 1" - 8"

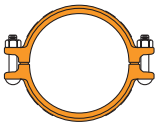


Fig. 7003 *Pages 38-39*
Hingelok® Coupling
Size Range: 1" - 4" and 5" - 8"

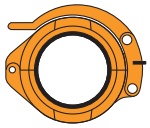


Fig. 7010 *Pages 40-41*
Reducing Coupling
Size Range: 2" x 1½" thru 8"x 6"

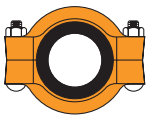
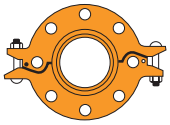


Fig. 7012 *Pages 43-45*
Gruvlok Flanges


Size Range: 2" - 12"

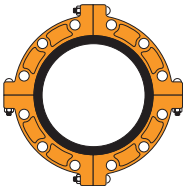

Size Range: 14" - 24"

Fig. 7788 *Page 42*
Gruvlok Flange Adapter
Size Range: 2" - 12"

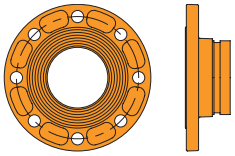
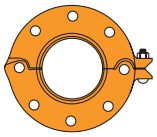


Fig. 7013 *Pages 46-48*
Gruvlok Flanges (#300 Flange)
Size Range: 2" - 12"



Flanged Seal Rings *Page 49*
Flange Adapter Inserts for use with Fig. 7012/7013 Flanges
Size Range: 2" - 24"

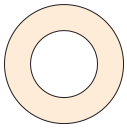
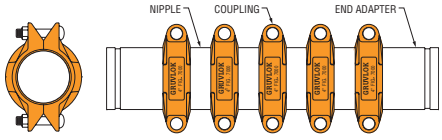


Fig. 7240 *Pages 50-51*
Expansion Joints
Size Range: 2" - 12"



BRANCH OUTLETS

Fig. 7042 *Pages 52-53*

Outlet Coupling
Size Range: 1½" - 6"

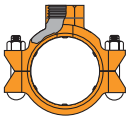


Fig. 7042F
Female IPS Outlet

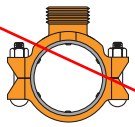


Fig. 7042M
Male IPS Outlet

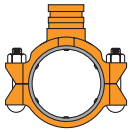
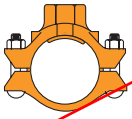
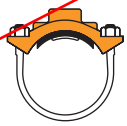


Fig. 7042G
Grooved Outlet

Fig. 7045 *Pages 54-56*

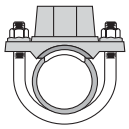


Clamp-T, FPT Branch
Size Range: 3" x 1¼" thru 8" x 4"



(U-Bolt)
Size Range: 2½" x ½" thru 4" x 1"

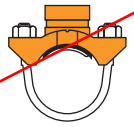
Fig. 7043 *Page 60*



Branch Outlet
Size Range: 1¼" x ½" thru 2½" x 1"

Fig. 7046 *Pages 57-58*

Clamp-T, Grooved Branch
Size Range: 3" x 1¼" thru 8" x 4"



(U-Bolt)
Size Range: 2½" x 1¼" thru 2½" x 1½"

Fig. 7047, Fig. 7048 & Fig. 7049 *Page 59*

Clamp-T Cross
Size Range: 2" x ½" thru 8" x 4"

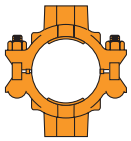


Fig. 7047
Thread x Thread

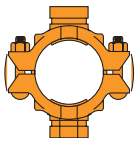


Fig. 7048
Groove x Groove

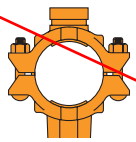


Fig. 7049
Groove x Thread

GROOVED FITTINGS

Fig. 7050 *Page 62*

90° Elbow
Size Range: 1" - 24"

Fig. 7051 *Page 62*

45° Elbow
Size Range: 1" - 24"

Fig. 7052 *Page 62*

22½° Elbow
Size Range: 1" - 24"

Fig. 7053 *Page 63*

11¼° Elbow
Size Range: 1" - 24"

Fig. 7050LR *Page 63*

90° Long Radius Elbow
Size Range: 1" - 24"

Fig. 7051LR *Page 63*

45° Long Radius Elbow
Size Range: 1" - 24"

Fig. 7060 *Page 64*

Tee
Size Range: 1" - 24"

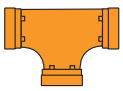


Fig. 7061 *Page 64*

Reducing Tee Standard
Size Range: 1¼" x 1¼" x 1" thru 24" x 24" x 20"

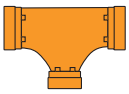


Fig. 7063 *Page 65*

Tee with Threaded Branch
Size Range: 1" - 12"

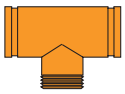


Fig. 7064 *Page 65*

Reducing Tee with Threaded Branch
Size Range: 2" x 2" x ¾" thru 24" x 24" x 12"

Fig. 7073 & Fig. 7097 *Page 66*

Eccentric Reducers
Size Range: 1¼" x 1" thru 24" x 20"

Fig. 7073
Groove x Groove

Fig. 7097
Groove x Thread

Fig. 7076 *Page 66*

Gr x Thd Concentric Reducer
Size Range: 1½" x 1" thru 6" x 4"

Fig. 7077, 7078 & 7079 *Page 67*

Swaged Nipples
Size Range: 2" x 1" thru 6" x 5"

Fig. 7077
Groove x Groove

Fig. 7078
Groove x Thread

Fig. 7079
Groove x Bevel

Fig. 7072 *Page 67*

Gr x Gr Concentric Reducer
Size Range: 1¼" x 1" thru 24" x 20"

Fig. 7070 *Page 68*

45° Reducing Lateral
Size Range: 3" x 3" x 2" thru 24" x 24" x 20"

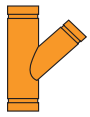


Fig. 7069 *Page 68*

45° Lateral
Size Range: 1" - 24"

Fig. 7071 *Page 69*

True Wye
Size Range: 1" - 24"

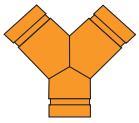


Fig. 7066 *Page 69*

Tee Wye
Size Range: 2" x 2" x 2" thru 12" x 12" x 12"

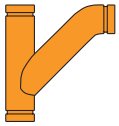


Fig. 7067 *Page 69*

Reducing Tee Wye
Size Range: 4" x 3" x 3" thru 8" x 6" x 8"

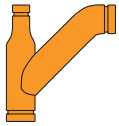


Fig. 7087 *Page 70*

Female Thread Adapter
Size Range: 1" - 4"

Fig. 7055 *Page 70*

90° Adapter Elbow
Size Range: 1" - 6"

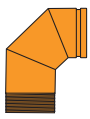


Fig. 7056 *Page 70*

45° Adapter Elbow
Size Range: 1" - 6"

GROOVED FITTINGS

Fig. 7050RF *Page 70*
Reducing Base Support Elbow
Groove x 150# Flange (GxF)
Size Range: 5" x 4" thru 12" x 10"

Fig. 7072GF *Page 71*
Gr x Flange Concentric Reducer
Size Range: 3" x 2" thru 8" x 6"

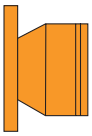


Fig. 7084 *Page 71*
Groove x Class 150 Flange Nipple
Size Range: 1" - 24"

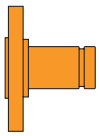


Fig. 7085 *Page 71*
Groove x Class 300 Flange Nipple
Size Range: 1" - 24"

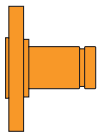


Fig. 7074 *Page 72*
Cap
Size Range: 1" - 24"

Fig. 7075 *Page 72*
Bull Plug
Size Range: 2" - 6"

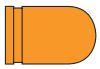


Fig. 7068 *Page 72*
Cross
Size Range: 1" - 24"

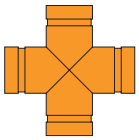


Fig. 7086 *Page 73*
Groove x Hose Nipple
Size Range: 1" - 12"

Fig. 7065 *Page 74*
Standpipe Tee (Gr x Gr x FPT)
Size Range: 4" x 4" x 2½" thru 6" x 6" x 2½"

Fig. 7062 *Page 74*
Bullhead Tee Specialty Tees (Gr x Gr x FPT)
Size Range: 5" x 5" x 8" thru 6" x 6" x 8"

Fig. 7050DR *Page 74*
90˚ Drain Elbow
Size Range: 1¼" - 12"

Fig. 7080, Fig. 7081 & Fig. 7082 *Page 73*
Nipples
Size Range: ¾" - 12"

Fig. 7080
Groove x Groove

Fig. 7081
Groove x MPT

Fig. 7082
Groove x Bevel

Fig. 7450 *Page 75*
90˚ Short Pattern Elbow
Size Range: 2" - 8"

Fig. 7460 *Page 75*
Short Pattern Tee
Size Range: 2" - 8"

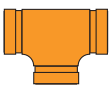


Fig. 7050-3D *Page 76*
Long Radius Elbows
Size Range: 2" - 24"

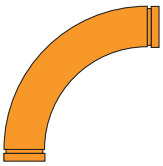


Fig. 7050-3D
90˚ Elbow

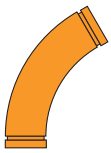


Fig. 7057-3D
60˚ Elbow

Fig. 7051-3D
45˚ Elbow

Fig. 7058-3D
30˚ Elbow

Fig. 7052-3D
22½˚ Elbow

Fig. 7053-3D
11¼˚ Elbow

Fig. 7050-5D *Page 77*
Long Radius Elbows
Size Range: 2" - 24"

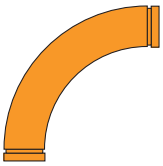


Fig. 7050-5D
90˚ Elbow

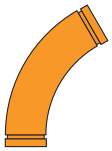


Fig. 7057-5D
60˚ Elbow

Fig. 7051-5D
45˚ Elbow

Fig. 7058-5D
30˚ Elbow

Fig. 7052-5D
22½˚ Elbow

Fig. 7053-5D
11¼˚ Elbow

Fig. 7050-6D *Page 78*
Long Radius Elbows
Size Range: 2" - 24"

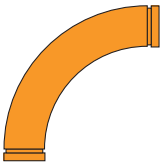


Fig. 7050-6D
90˚ Elbow

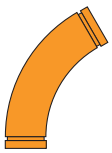


Fig. 7057-6D
60˚ Elbow

Fig. 7051-6D
45˚ Elbow

Fig. 7058-6D
30˚ Elbow

Fig. 7052-6D
22½˚ Elbow

Fig. 7053-6D
11¼˚ Elbow

PRODUCTS FOR GROOVED PIPING SYSTEM

The Gruvlok® System has been manufactured since the late 1960's. The Gruvlok product line has grown from standard couplings and fittings to today's extensive range of grooved product, plain-end product, butterfly valves, check valves, pump protection components, pipe preparation tools and various accessories.

Gruvlok is part of our overall commitment to provide today's piping industry with tomorrow's products.

c UL us LISTED
FM APPROVED
LPCB
VdS
UPC FOUNDED 1926 IAPMO®
DNV
U.S. GREEN BUILDING COUNCIL MEMBER

For Listings/Approval Details and Limitations, visit our website at www.anvilintl.com or contact an Anvil® Sales Representative.

Certified to ANSI/NSF 61

ISO 9001:2008

INDUSTRY & GOVERNMENT STANDARDS & APPROVALS

ANSI	American National Standards Institute
API	American Petroleum Institute: API Std. 5L, Sect. 7.5
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers: Power Piping, B 31.1; Chemical Plant and Petroleum Refinery Piping, B 31.3; Refrigeration Piping, B 31.5; Building Services Piping, B 31.9; Slurry Pipelines, B 31.11
ASTM	American Society of Testing and Materials: F 1476, F 1387
AWWA	American Water Works Association: C 606
BV	Bureau Veritas
CDF	California State Fire Marshal
COE	Corps of Engineers: CEGS 15000
CSA	Canadian Standards Association: B 242
DNV	Det Norske Veritas
	Hong Kong Fire Services Board
	New Zealand Insurance Council
	New Zealand Building Act. (1991)
FAA	Federal Aviation Administration: HVAC, Plumbing, Fire Protection
FHA	Federal Housing Administration
FM	Factory Mutual Engineering Corp.
GSA	General Services Administration: 15000 Series
IAPMO	International Association of Plumbing & Mechanical Officials
LPC	Loss Prevention Council
MEA	Materials & Equipment Acceptance
MIL	Military Specifications: MILP-10388 Fittings; MIL-C-10387 Couplings; MIL-P-11087A(CE) Steel Pipe, Grooved MIL-I-45208 Inspection Procedure
NASA	National Aeronautics and Space Administration: 15000 Series
NAVFAC	Naval Facilities Engineering Command: NFGS 15000 Series
NFPA	National Fire Protection Association
NIH	National Institute of Health (Dept. of Health): 15000 Series
NSF	NSF International
NY-BSA	New York Board of Standards and Appeals
NYC	New York City
TVA	Tennessee Valley Authority: Fire protection, storm drains
UL	Underwriter's Laboratories, Inc.
ULC	Underwriter's Laboratories of Canada
	Bureau of Marine Inspection: Salt and fresh water, oil transfer
	Bureau of Public Roads; Div. of Bridges: Drain lines and bridge crossings
	Canadian Coast Guard
	U.S. Coast Guard –Approves each vessel individually
USGBC	United States Green Building Council
VA	Veterans Affairs : 15000 Series
VdS	Verband der Sachversicherer e.V.

Note: Please refer to product specific pages for exact listings and approvals related to a specific size for a specific product.

GRUVLOK® – THE ENGINEERED COUPLING

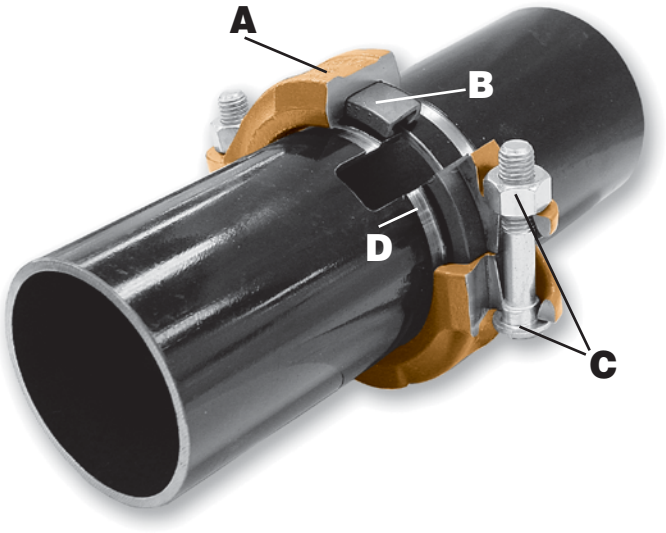
HOUSING (A) FLEXIBLE OR RIGID

The Gruvlok Coupling housing is designed to self-center around the pipe. The housing encircles and retains the gasket against the application of internal system pressure or vacuum.

The housing key sections fit into and engage the pipe-end grooves around the entire pipe circumference, thus restraining the pipe ends from separation due to the application of internal pressure.

Flexible Couplings provide designed-in clearances between the housing key sections and the pipe grooves to permit both angular and longitudinal movement of the pipe. Rigid couplings grip the pipe and lock the joint into position.

All housings are coated with paint for general service applications. The paint serves to provide protection against normal atmospheric corrosion. However, for couplings used in corrosive environments, hot-dip galvanizing, and stainless steel are available.

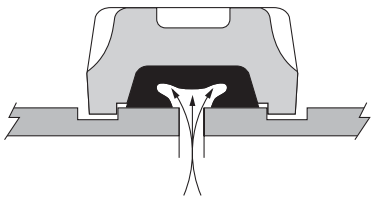


GASKET (B)

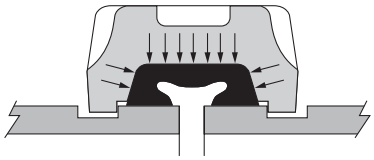
The unique single piece "C" style design of the gasket has been engineered to provide a pressure responsive, leak-tight seal in both pressure and vacuum applications without the aid of external forces. The "lips" of the gasket are molded so that upon installation onto the pipe ends they provide compression against the pipe surface to establish the leak-tight seal.

The gasket cavity functions as a "pressure reservoir". Pressure within the pipe system is applied to the internal surfaces of the gasket which increases the sealing force and enhances the leak-tight seal. In vacuum systems, non-pressure-responsive seals tend to "lift off" the pipe, producing leak paths. However, the Gruvlok gasket reacts to the negative pressure (higher outside atmospheric pressure) as to improve the sealing capability of the gasket.

Gasket Reaction to Pressure



Gasket Reaction to Vacuum



BOLTS AND NUTS (C)

Heat treated oval neck track head bolts serve to connect and secure the housing segments together. The oval neck design prevents turning of the bolt while tightening the hex nut with a single wrench. The bolt size and corresponding wrench (or socket) size for the hex nuts are shown in the chart below.

ANSI

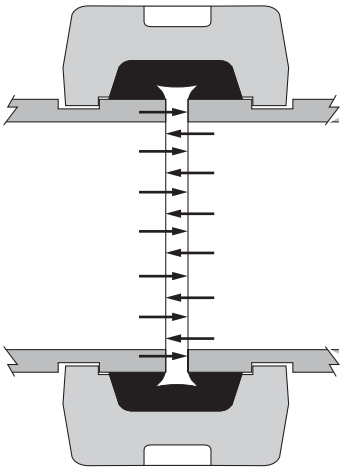
Bolt Size	3/8	1/2	5/8	3/4	7/8	1	1 1/4
Wrench Size	11/16	7/8	1 1/16	1 1/4	1 7/16	1 5/8	2

METRIC

Bolt Size	M10	M12	M16	M20	M22
Wrench Size	16	22	24	30	34

GROOVED PIPE ENDS (D)

The ends of the pipe must have a groove in them which may be either cut grooved or roll grooved. The grooved pipe ends engage the coupling keys, thus, providing a self-restraining, mechanical joint capable of resisting the separation of the pipe ends due to the application of system pressure. The groove diameters must be dimensionally accurate to obtain the maximum benefit of the Gruvlok Coupling.



THE GRUVLOK® PIPING METHOD

Gruvlok couplings and grooved-end fittings are widely used for joining pipe in a wide variety of piping systems. Gruvlok couplings for grooved-end pipe are designed to provide a self-centering joint which accommodates the application of pressure, vacuum and other external forces, while limiting the burdensome need for special supports, expansion joints, etc.

The Gruvlok piping method offers many mechanical design features which benefit the design engineer, the contractor, and the end user. Utilization of the functional characteristics of the Gruvlok coupling will aid in pipe system design and must be considered for proper installation, assembly and performance.

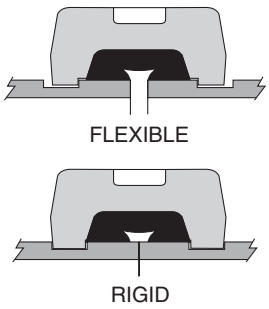
The design factors presented in the Gruvlok technical data section should always be referenced to when designing any grooved piping system to obtain the maximum benefit of the Gruvlok piping method.

GRUVLOK FEATURES

RIGIDITY OR FLEXIBILITY

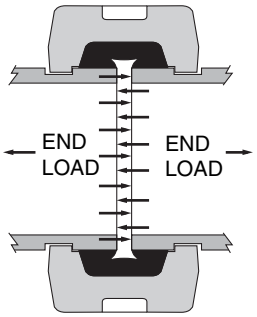
Couplings are available where rigid connections are required. Rigid couplings are clearly marked with an "X" for identification.

Couplings with flexible design allow for pipe expansion and contractions with temperature changes. The need for an expansion joint is minimized or eliminated.



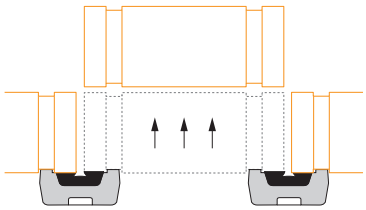
SELF RESTRAINED JOINT

The couplings engage the pipe around the entire circumference and restrain the pipe ends from separation due to pressure and other forces, up to the maximum coupling rated working pressure.



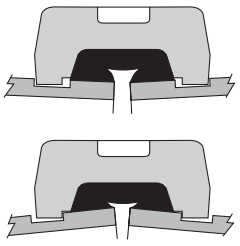
UNION AT EVERY JOINT

Gruvlok couplings can be disassembled easily permitting maintenance and servicing of the piping system. It will facilitate periodic rotation of pipe to distribute internal wear from slurries or other abrasive media.



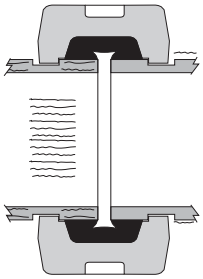
STRESS-FREE SYSTEM

Flexibility designed in the Gruvlok coupling absorbs and eliminates stress from settlement of buried pipe or those induced by seismic tremors.



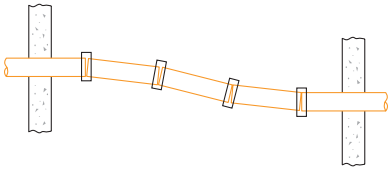
MINIMIZES NOISE & VIBRATION

The resilient elastomeric gasket and pre-designed gap of the Gruvlok coupling help isolate and absorb noise and vibration, this minimizes vibration transmission.



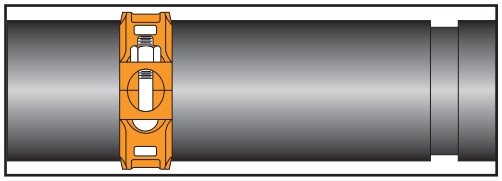
ACCOMMODATES MISALIGNMENT AND JOINT DEFLECTION

The flexibility designed into the Gruvlok coupling will accommodate misalignments caused by imprecise location of pipe opening through walls and floors, will provide pitch for drainage piping systems and facilitate laying pipe on uneven terrain, thus permitting deflection in any direction.



GRUVLOK® COUPLINGS FOR GROOVED-END PIPE

Gruvlok couplings for grooved-end pipe are available in nominal pipe sizes 1" thru 60" and metric sizes. The variety of coupling designs provide a universal means for the connection of pipe, fittings and pipe system components. The wide assortment of Gruvlok couplings and gaskets permit selection of the most suitable combination for a specific application, thus providing the most versatile and economical pipe system installation.



MATERIAL SPECIFICATIONS

BOLTS:
SAE J429, Grade 5, Zinc Electroplated
ISO 898-1, Class 8.8, Zinc Electroplated followed by a Yellow Chromate Dip

HEAVY HEX NUTS:
ASTM A563, Grade A, Zinc Electroplated
ISO 898-2, Class 8.8, Zinc Electroplated followed by a Yellow Chromate Dip

STAINLESS STEEL BOLTS & NUTS:
Stainless steel bolts and nuts are available for the Fig. 7001, 7401, 7401-2, 7001-2, 7004, 7000 and 7400 couplings in standard 304SS, (316SS available as special order)

HOUSING:
Ductile Iron conforming to ASTM A 536, Grade 65-45-12

COATINGS:
Rust inhibiting paint Color: ORANGE (standard)
Hot Dipped Zinc Galvanized (optional)
Other Colors Available (IE: RAL3000 and RAL9000)
For other Coating requirements contact an Anvil Representative.

GASKETS: Materials
Properties as designated in accordance with ASTM D 2000

GRADE "EP" EPDM (Green/Red color code) NSF-61 Certified
-40°F to 250°F (Service Temperature Range)(-40°C to 121°C)
Recommended for water service, diluted acids, alkalies solutions, oil-free air and many other chemical services.
NOT FOR USE IN PETROLEUM APPLICATIONS.

GRADE "E" EPDM (Green color code) NSF-61 Certified
-40°F to 230°F (Service Temperature Range)(-40°C to 110°C)
Recommended for water service, diluted acids, alkalies solutions, oil-free air and many chemical services.
NOT FOR USE IN PETROLEUM APPLICATIONS.

GRADE "T" Nitrile (Orange color code)
-20°F to 180°F (Service Temperature Range)(-29°C to 82°C)
Recommended for petroleum applications. Air with oil vapors and vegetable and mineral oils.
NOT FOR USE IN HOT WATER OR HOT AIR

GRADE "O" Fluoro-Elastomer (Blue color code)
Size Range: 1" - 12" (C style only)
20°F to 300°F (Service Temperature Range)(-29°C to 149°C)
Recommended for high temperature resistance to oxidizing acids, petroleum oils, hydraulic fluids, halogenated hydrocarbons and lubricants

GRADE "L" Silicone (Red color code)
Size Range: 1" - 12" (C style only)
-40°F to 350°F (Service Temperature Range)(-40°C to 177°C)
Recommended for dry, hot air and some high temperature chemical services

GASKET TYPE:
Standard C Style
Flush Gap: 1" - 24"
End Guard: 1" - 12" (Fig. 7004 and 7377)
SlideLOK: 2" - 8"

LUBRICATION:
Standard Gruvlok
Gruvlok Xtreme™ (Do Not use with Grade "L")

WORKING PRESSURE, END LOAD, PIPE END SEPARATION & DEFLECTION FROM CENTER LINE:
Based on standard wall steel pipe with cut or roll grooves in accordance with Gruvlok specifications. Pressure ratings for light wall, stainless steel, aluminum, and ISO pipe available. See technical data section.

COUPLING DATA CHART NOTES

COUPLING DATA CHART NOTES														
Nominal Size	O.D.	Max. Work. Pressure	Max. End Load	Range of Pipe End Separation	Deflection from ℄		Coupling Dimensions			Coupling Bolts		Specified Torque		Approx. Wt. Ea.
					Per Coupling	of Pipe	X	Y	Z	Qty.	Size	Min.	Max.	
In./DN(mm)	*In./mm*	*PSI/bar*	*Lbs./kN*	*In./mm*	*Degrees(°)-Minutes(')*	*In./ft-mm/m*	*In./mm*	*In./mm*	*In./mm*		*In./mm*	*Ft.-Lbs/N-m*		*Lbs./kg*
1	2	3	4	5	6		7			8		9		10

1 Gruvlok Couplings are identified by either the nominal ANSI pipe size in inches or pipe O.D. in millimeters (see column 2).

2 Nominal Outside Diameter of Pipe.

3 Maximum line pressure, including surge, to which a joint can be subjected. Working pressure ratings are based on standard wall steel pipe with standard cut or roll grooves in accordance with Gruvlok specifications. For Performance Data on other than standard wall pipe, refer to Technical data section. **NOTE: For one time field test only, the maximum joint working pressure may be increased to 1.5 times the figure shown unless otherwise noted.**

4 Maximum end load from all interior and/or exterior forces to which the joint can be subjected are based on standard wall steel pipe with standard cut or roll grooves in accordance with Gruvlok specifications.

5 Range of pipe end separation for roll grooved pipe, Double values shown when using cut groove pipe; see page 222 for details.

6 Maximum allowable angular deflection values from centerline when using standard roll grooved pipe; Double values shown when using cut groove pipe; see page 222 for details.

7 "X", "Y", and "Z" are external dimensions for reference purposes only.

8 The quantity of bolts per coupling.

9 Nuts must be tightened alternating and evenly to the specified bolt torque. See individual product installation instructions for additional important information.

10 Approximate weight for a fully assembled coupling with gasket, bolts, and nuts.

FIG. 7401

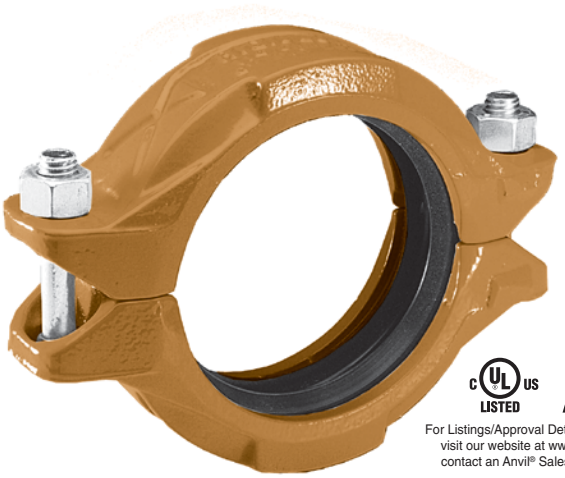
Rigidlok® Coupling

The Fig. 7401 Rigidlok Coupling is an ideal connector for service and applications that require a rigid connection.

The Fig. 7401 Rigidlok coupling utilizes a technologically advanced housing design that conforms to and grips the pipe.

Coupling installation is fast and easy, remove only one nut and swing the housing over the gasket and into the grooves. The exclusive Guidelok® feature automatically separates the grooved pipe ends and guides the coupling into position as the bolts are tightened. Precisely sized and oriented tines in the housing key section firmly grip the pipe. The combination of these designed in features produce a secure, rigid pipe joint connection.

The Fig. 7401 Rigidlok Coupling is designed for use with roll grooved or cut grooved standard weight and roll grooved lightweight pipe, as well as with grooved-end fittings and valves. The Rigidlok Coupling provides a rigid pipe connection allowing pipe hanging practices per ASME B31 pipe codes.



c UL us LISTED FM APPROVED

For Listings/Approval Details and Limitations, visit our website at www.anvilintl.com or contact an Anvil® Sales Representative.

The Fig. 7401 Rigidlok Coupling allows for a maximum working pressure of 750 psi (51.7 bar) when used on standard wall roll or cut grooved pipe.

MATERIAL SPECIFICATIONS

BOLTS:
SAE J429, Grade 5, Zinc Electroplated
ISO 898-1, Class 8.8, Zinc Electroplated followed by a Yellow Chromate Dip

HEAVY HEX NUTS:
ASTM A563, Grade A, Zinc Electroplated
ISO 898-2, Class 8.8, Zinc Electroplated followed by a Yellow Chromate Dip

STAINLESS STEEL BOLTS & NUTS:
304SS bolts and nuts are available as a standard option.
(316SS are available for special order).

HOUSING:
Ductile Iron conforming to ASTM A 536, Grade 65-45-12

COATINGS:
Rust inhibiting paint – Color: ORANGE (standard)
Hot Dipped Zinc Galvanized (optional)
Other Colors Available (IE: RAL3000 and RAL9000)
For other Coating requirements contact an Anvil Representative.

GASKETS: Materials
Properties as designated in accordance with ASTM D 2000

Grade "EP" EPDM (Green and Red color code)
-40°F to 250°F (Service Temperature Range)(-40°C to 121°C)
Recommended for water service, diluted acids, alkalies solutions, oil-free air and many other chemical services.
NOT FOR USE IN PETROLEUM APPLICATIONS.

For hot water applications the use of Gruvlok Extreme Temperature lubricant is recommended. NSF-61 Certified for cold and hot water applications up through 12".

Grade "T" Nitrile (Orange color code)
-20°F to 180°F (Service Temperature Range)(-29°C to 82°C)
Recommended for petroleum applications. air with oil vapors and vegetable and mineral oils.
NOT FOR USE IN HOT WATER OR HOT AIR

Grade "O" Fluoro-Elastomer (Blue color code)
Size Range: 1" - 12" (C style only)
20°F to 300°F (Service Temperature Range)(-29°C to 149°C)
Recommended for high temperature resistance to oxidizing acids, petroleum oils, hydraulic fluids, halogenated hydrocarbons and lubricants.

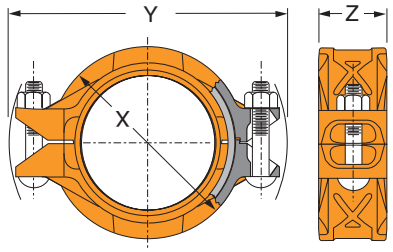
Grade "L" Silicone (Red color code)
Size Range: 1" - 12" (C style only)
-40°F to 350°F (Service Temperature Range)(-40°C to 177°C)
Recommended for dry, hot air and some high temperature chemical services. Contact an Anvil Representative for availability.

GASKET TYPE:
C Style (1" - 24")
Flush Gap (1" - 24")

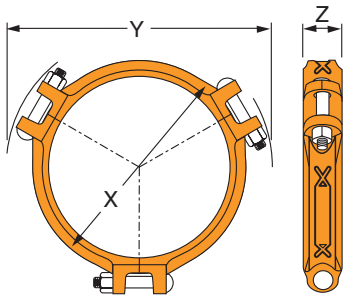
LUBRICATION:
Standard
Gruvlok Xtreme™ (Do Not use with Grade "L")

FIG. 7401

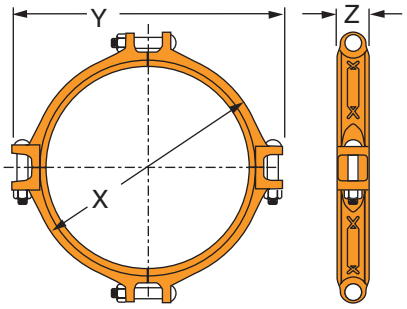
Rigidlok® Coupling



SIZES 1 1/2" - 14"



SIZE 16"



SIZES 18" - 24"

FIGURE 7401 RIGIDLOK COUPLING

Nominal Size	O.D.	Max. Working Pressure†	Max. End Load	Range of Pipe End Separation	Coupling Dimensions			Coupling Bolts*		Specified Torque §		Approx. Wt. Ea.
					X	Y	Z	Qty.	Size	Min.	Max.	
In./DN(mm)	*In./mm*	*PSI/bar*	*Lbs./kN*	*In./mm*	*In./mm*	*In./mm*	*In./mm*		*In./mm*	*Ft.-Lbs/N-M*		*Lbs./kg*
1½	1.900	750	2,126	0-1/32	3	5⅛	1⅞	2	⅜ x 2¼	30	45	1.8
40	*48.3*	*51.7*	*9.46*	*0-0.79*	*76*	*130*	*48*		*M10 x 57*	*40*	*60*	*0.8*
2	2.375	750	3,323	0-1/32	3½	5⅝	1⅞	2	⅜ x 2½	30	45	2.4
50	*60.3*	*51.7*	*14.78*	*0-0.79*	*89*	*143*	*48*		*M10 x 63*	*40*	*60*	*1.1*
2½	2.875	750	4,869	0-1/32	4	6⅛	1⅞	2	⅜ x 2½	30	45	2.9
65	*73.0*	*51.7*	*21.66*	*0-0.79*	*102*	*156*	*48*		*M10 x 63*	*40*	*60*	*1.3*
3 O.D.	*2.996*	*750*	*5,207*	*0-1/32*	*4⅛*	*6⅛*	*1⅞*	*2*	*⅜ x 2½*	*80*	*100*	*3.4*
76.1	76.1	51.7	23.52	0-0.79	105	156	48		M10 x 63	110	150	1.5
3	3.500	750	7,216	0-1/32	4¾	7¼	1⅞	2	½ x 3	80	100	3.6
80	*88.9*	*51.7*	*32.10*	*0-0.79*	*121*	*184*	*48*		*M12 x 76*	*110*	*150*	*1.6*
4	4.500	750	11,928	0-3/32	5⅞	8⅜	2⅛	2	½ x 3	80	100	5.0
100	*114.3*	*51.7*	*53.06*	*0-2.38*	*149*	*213*	*54*		*M12 x 76*	*110*	*150*	*2.3*
5½ O.D.	*5.500*	*750*	*17,819*	0-3/32	*7*	*9¼*	*2⅛*	*2*	*⅝ x 3½*	*100*	*130*	*6.9*
139.7	139.7	51.7	79.26	*0-2.38*	178	248	54		M16 x 85	135	175	3.1
5	5.563	750	18,229	0-3/32	7	10	2⅛	2	⅝ x 3½	100	130	6.9
125	*141.3*	*51.7*	*81.09*	*0-2.38*	*178*	*254*	*54*		*M16 x 85*	*135*	*175*	*3.1*
6½ O.D.	*6.500*	*750*	*24,887*	*0-3/32*	*8*	*11*	*2⅛*	*2*	*⅝ x 3½*	*100*	*130*	*7.6*
165.1	165.1	51.7	110.70	0-2.38	203	279	54		M16 x 85	135	175	3.4
6	6.625	750	25,854	0-3/32	8⅛	11⅛	2⅛	2	⅝ x 3½	100	130	7.9
150	*168.3*	*51.7*	*115.00*	*0-2.38*	*206*	*283*	*54*		*M16 x 85*	*135*	*175*	*3.6*
8	8.625	600	35,056	0-3/32	10½	14⅛	2⅝	2	¾ x 4½	130	180	15.9
200	*219.1*	*41.4*	*155.94*	*0-2.38*	*267*	*359*	*67*		*M20 x 110*	*175*	*245*	*7.2*
10	10.750	500	45,381	0-3/32	12⅞	17½	2⅝	2	1 x 6	200	250	25.6
250	*273.1*	*34.5*	*201.87*	*0-2.38*	*327*	*445*	*67*		*M24 x 150*	*270*	*340*	*11.6*
12	12.750	400	51,070	0-3/32	15	19½	2⅝	2	⅞ x 6	180	220	30.5
300	*323.9*	*27.6*	*227.17*	*0-2.38*	*381*	*495*	*67*		*M22 x 150*	*245*	*300*	*13.8*
14	14.000	300	46,181	0-3/32	16¼	19¾	3	2	⅞ x 5½	180	220	36.1
350	*355.6*	*20.7*	*205.43*	*0-2.38*	*413*	*502*	*76*		*M22 x 140*	*245*	*300*	*16.4*
16	16.000	300	60,319	0-3/32	18⅛	22¼	3	3	⅞ x 5½	180	220	42.0
400	*406.4*	*20.7*	*268.31*	*0-2.38*	*460*	*565*	*76*		*M22 x 140*	*245*	*300*	*19.1*
18	18.000	300	76,341	0-3/32	20½	24⅜	3⅛	4	1 x 4	200	250	51.6
450	*457.2*	*20.7*	*339.58*	*0-2.38*	*521*	*619*	*79*		*M24 x 100*	*270*	*340*	*23.4*
20	20.000	300	94,248	0-3/32	23	26⅞	3⅛	4	1 x 4	200	250	68.3
500	*508.0*	*20.7*	*419.23*	*0-2.38*	*581*	*683*	*79*		*M24 x 100*	*270*	*340*	*31.0*
24	24.000	250	113,097	0-3/32	27⅛	30⅞	3⅛	4	1 x 4	200	250	89.3
600	*609.6*	*17.2*	*503.08*	*0-2.38*	*689*	*784*	*79*		*M24 x 100*	*270*	*340*	*40.5*

NOTE:

Range of Pipe End Seperation values are for roll grooved pipe and may be doubled for cut groove pipe.

†Maximum Working Pressure Rating is for schedule 40 steel pipe. For light wall, stainless steel, aluminum and ISO pipe pressure ratings, please refer to the technical data section.

For additional details see "Coupling Data Chart Notes" on page 17.
* Available in ANSI or metric bolt sizes only as indicated.
§ – For additional Bolt Torque information, see page 222.
See Installation & Assembly directions on page 183.
Not for use in copper systems.

FIG. 7401-2

Rigidlok® Coupling

Gruvlok® introduces new 2-piece large diameter standard groove couplings in both rigid and flexible styles

- Uses standard grooves (conforming to AWWA C-606)
- No special grooves or grooving tools needed
- Pressures to 350 P.S.I. on cut or roll grooved pipe with a wall thickness of 0.250" or greater
- No special fittings needed
- No special valves needed
- Up to 23% less weight than competitive models
- Sizes: 14" through 24" in Rigid: Figure 7401-2

MATERIAL SPECIFICATIONS

BOLTS:
SAE J429, Grade 5, Zinc Electroplated

HEAVY HEX NUTS:
ASTM A563, Grade A, Zinc Electroplated

STAINLESS STEEL BOLTS & NUTS:
304SS bolts and nuts are available as a standard option.
(316SS are available for special order).

HOUSING:
Ductile Iron conforming to ASTM A 536, Grade 65-45-12

COATINGS:
Rust inhibiting paint – Color: ORANGE (standard)
Hot Dipped Zinc Galvanized (optional)
Other Colors Available (IE: RAL3000 and RAL9000)
For other Coating requirements contact an Anvil Representative.

GASKETS: Materials
Properties as designated in accordance with ASTM D 2000

Grade "E" EPDM (Green color code)
-40°F to 230°F (Service Temperature Range)(-40°C to 110°C)
Recommended for water service, diluted acids, alkalies solutions, oil-free air and many other chemical services.
NOT FOR USE IN PETROLEUM APPLICATIONS.

Grade "T" Nitrile (Orange color code)
-20°F to 180°F (Service Temperature Range)(-29°C to 82°C)
Recommended for petroleum applications. Air with oil vapors and vegetable and mineral oils.
NOT FOR USE IN HOT WATER OR HOT AIR

GASKET TYPE:
Flush Gap (Standard)

LUBRICATION:
Standard
Gruvlok Xtreme™

WORKING PRESSURE, END LOAD & PIPE END SEPARATION:
Based on standard wall steel pipe with cut or roll grooves in accordance with Gruvlok specifications. See technical data section for design factors.

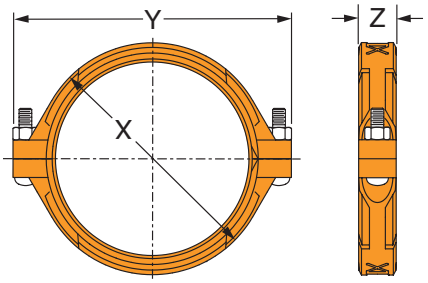


FIGURE 7401-2 RIGIDLOK COUPLING

Nominal Size	O.D.	Max. Working Pressure	Max. End Load	Range of Pipe End Separation	Coupling Dimensions			Coupling Bolts*		Specified Torque §		Approx. Wt. Ea.
					X	Y	Z	Qty.	Size	Min.	Max.	
In./DN(mm)	*In./mm*	*PSI/bar*	*Lbs./kN*	*In./mm*	*In./mm*	*In./mm*	*In./mm*		*In./mm*	*Ft.-Lbs/N-M*		*Lbs./kg*
14 *350*	14.000 *355.6*	350 *24.1*	53,878 *239.66*	0-3/32 *0-2.38*	16 1/4 *413*	19 3/4 *502*	3 *76*	2	7/8 x 5 1/2 –	180 *245*	220 *300*	36.5 *16.6*
16 *400*	16.000 *406.4*	350 *24.1*	70,372 *313.03*	0-3/32 *0-2.38*	18 5/16 *465*	22 *558*	3 *76*	2	1 x 5 1/2 –	250 *340*	300 *408*	46.0 *20.9*
18 *450*	18.000 *457.2*	350 *24.1*	89,064 *396.18*	0-3/32 *0-2.38*	20 3/4 *527*	24 1/4 *615*	3 1/8 *79*	2	1 x 5 1/2 –	250 *340*	300 *408*	62.5 *28.3*
20 *500*	20.000 *508.0*	350 *24.1*	109,956 *489.11*	0-3/32 *0-2.38*	23 *582*	27 1/8 *691*	3 1/8 *79*	2	1 1/8 x 5 1/2 –	375 *510*	425 *578*	73.5 *33.3*
24 *600*	24.000 *609.6*	350 *24.1*	158,336 *704.31*	0-3/32 *0-2.38*	27 1/4 *688*	31 1/8 *791*	3 3/16 *81*	2	1 1/8 x 5 1/2 –	375 *510*	425 *578*	90.5 *41.1*

Range of Pipe End Separation values are for roll grooved pipe and may be doubled for cut groove pipe.
See Installation & Assembly directions on page 189.

FIG. 74

SlideLOK® Ready for Installation Coupling

Patent D680629, D680630, D696751

SlideLOK Pressure Responsive Gasket

The SlideLOK coupling is the most rigid ready for installation coupling designed to reduce installation time. The slide action eases assembly and reduces installation time. The patented gasket provides four separate sealing surfaces for added protection.

The SlideLOK coupling is designed to be used with roll groove or cut groove steel pipe, grooved light wall pipe, Gruvlok® grooved-end fittings, and valves.

The SlideLOK coupling allows for a maximum working pressure of 750 psi on roll or cut grooved carbon steel standard wall pipe. Contact an Anvil representative for light wall and stainless steel pipe pressure ratings. The SlideLOK coupling provides a rigid connection allowing pipe hanging practices per ASME B31 Pipe Codes.

MATERIAL SPECIFICATIONS

BOLTS:
SAE J429, Grade 5, Zinc Electroplated

HEAVY HEX NUTS:
ASTM A563, Grade A, Zinc Electroplated

HOUSING:
Ductile Iron conforming to ASTM A 536, Grade 65-45-12

COATINGS:
Rust inhibiting paint Color: ORANGE (standard)
Hot Dipped Zinc Galvanized (optional)

GASKETS: Materials
Properties as designated in accordance with ASTM D 2000

Grade "EP" EPDM (Green and Red color code)
-40°F to 250°F (Service Temperature Range)(-40°C to 121°C)
Recommended for water service, diluted acids, alkalies solutions, oil-free air and many other chemical services.
NOT FOR USE IN PETROLEUM APPLICATIONS.

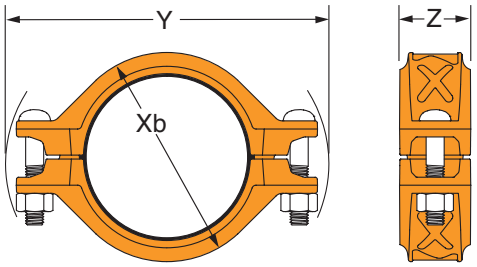
Grade "T" Nitrile (Orange color code)
-20°F to 180°F (Service Temperature Range)(-29°C to 82°C)
Recommended for petroleum applications. air with oil vapors and vegetable and mineral oils.
NOT FOR USE IN HOT WATER OR HOT AIR

GASKET TYPE:
SlideLOK (2" - 8")

LUBRICATION:
Standard
Gruvlok Xtreme™

FIG. 74

SlideLOK® Ready for Installation Coupling



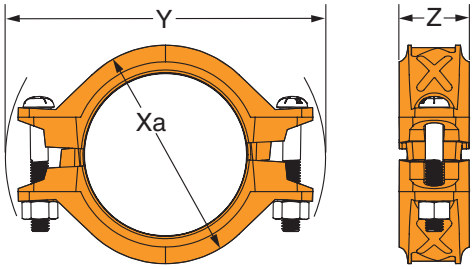


FIGURE 74 SLIDELOK COUPLING

Nominal Size	O.D.	Max. Working Pressure †	Max. End Load	Range of Pipe End Separation	Coupling Dimensions				Coupling Bolts		Specified Torque §		Approx. Wt. Ea.
					Xa	Xb	Y	Z	Qty.	Size	Min.	Max.	
In./DN(mm)	*In./mm*	*PSI/bar*	*Lbs./kN*	*In./mm*	*In./mm*	*In./mm*	*In./mm*	*In./mm*		*In./mm*	*Ft.-Lbs/N-M*		*Lbs./kg*
2 *50*	2.375 *60.3*	750 *51.7*	3,323 *14.78*	0-1/32 *0-0.79*	3¾ *95*	3⅜ *86*	6 *152*	2 *51*	2	½ x 2¾ *M12 x 70*	80 *110*	100 *150*	2.9 *1.3*
2½ *65*	2.875 *73.0*	750 *51.7*	4,869 *21.66*	0-1/32 *0-0.79*	4⅝ *117*	4¼ *108*	6⅜ *163*	2 *51*	2	½ x 2¾ *M12 x 70*	80 *110*	100 *150*	3.1 *1.4*
3 *80*	3.500 *88.9*	750 *51.7*	7,216 *32.10*	0-1/32 *0-0.79*	5⅕ *132*	4 11/16 *119*	7 *178*	2 *51*	2	½ x 3½ *M12 x 89*	80 *110*	100 *150*	3.6 *1.6*
4 *100*	4.500 *114.3*	750 *51.7*	11,928 *53.06*	0-3/32 *0-2.38*	6½ *165*	6 *152*	8 5/16 *212*	2 *51*	2	½ x 3½ *M12 x 89*	80 *110*	100 *150*	4.9 *2.2*
5 *125*	5.563 *141.3*	750 *51.7*	18,229 *81.09*	0-3/32 *0-2.38*	7¾ *196*	7⅛ *181*	9¾ *248*	2 *51*	2	⅝ x 3½ *M16 x 89*	100 *135*	130 *175*	6.1 *2.8*
6 *150*	6.625 *168.3*	700 *48.3*	24,130 *107.34*	0-3/32 *0-2.38*	8⅞ *224*	8⅕ *208*	10⅘ *274*	2 *51*	2	⅝ x 3½ *M16 x 89*	100 *135*	130 *175*	6.8 *3.1*
8 *200*	8.625 *219.1*	600 *41.4*	35,056 *155.94*	0-3/32 *0-2.38*	11⅜ *289*	10⅝ *270*	13⅜ *340*	2½ *64*	2	¾ x 4½ *M20 x 115*	130 *175*	180 *245*	10.9 *4.9*

NOTES:

Range of Pipe End Separation values are for roll grooved pipe and may be doubled for cut groove pipe.

†Maximum Working Pressure Rating is for schedule 40 steel pipe. For light wall, stainless steel, aluminum and ISO pipe pressure ratings, please refer to the technical data section.

Impact gun can be used for installation, verify that the output of the impact gun is within the required torque range.

Not for use on "EG" rolled or cut grooved pipe ends.

Contact an Anvil Representative for use on light wall and SS pipe applications.

For additional details see "Coupling Data Chart Notes" on page 17.
§ – For additional Bolt Torque information, see page 222.
See Installation & Assembly directions on pages 184-185.
Not for use in copper systems.

FIG. 7402

SlideLOK® Ready for Installation Coupling

Patent D680629, D680630, D696751

SlideLOK Pressure Responsive Gasket

The SlideLOK coupling is a ready for installation coupling designed to reduce installation time. The slide action allows for greater flexibility during installation. The patented gasket provides four separate sealing surfaces for added protection. The engineered metal-to-metal installation requirement is a quick and easy indication of proper assembly.

The SlideLOK is designed to be used with roll groove or cut groove steel pipe, as well as with grooved light wall pipe, Gruvlok® grooved-end fittings, and valves. The SlideLOK coupling produces a secure, rigid pipe joint connection.

The SlideLOK coupling allows for a maximum working pressure of 750 psi on roll or cut grooved standard wall pipe. Contact an Anvil representative for light wall pipe pressure ratings. The SlideLOK coupling maintains a rigid connection with support and hanging in conformance with applicable ANSI B31.1 Power Piping Code, ANSI B31.9 Building Service Pipe Code.

MATERIAL SPECIFICATIONS

BOLTS:
SAE J429, Grade 5, Zinc Electroplated

HEAVY HEX NUTS:
ASTM A563, Grade A, Zinc Electroplated

HOUSING:
Ductile Iron conforming to ASTM A 536, Grade 65-45-12

COATINGS:
Rust inhibiting paint Color: ORANGE (standard)
Hot Dipped Zinc Galvanized (optional)

GASKETS: Materials
Properties as designated in accordance with ASTM D 2000

Grade "EP" EPDM (Green and Red color code)
-40°F to 250°F (Service Temperature Range)(-40°C to 121°C)
Recommended for water service, diluted acids, alkalies solutions, oil-free air and many other chemical services.
NOT FOR USE IN PETROLEUM APPLICATIONS.

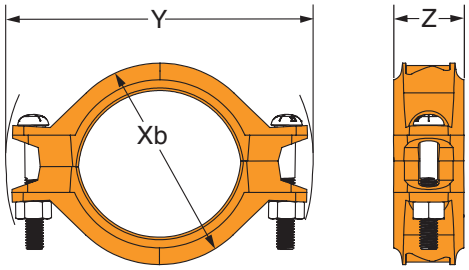
Grade "T" Nitrile (Orange color code)
-20°F to 180°F (Service Temperature Range)(-29°C to 82°C)
Recommended for petroleum applications. air with oil vapors and vegetable and mineral oils.
NOT FOR USE IN HOT WATER OR HOT AIR

GASKET TYPE:
SlideLOK (2" - 8")

LUBRICATION:
Standard
Gruvlok Xtreme™

FIG. 7402

SlideLOK® Ready for Installation Coupling



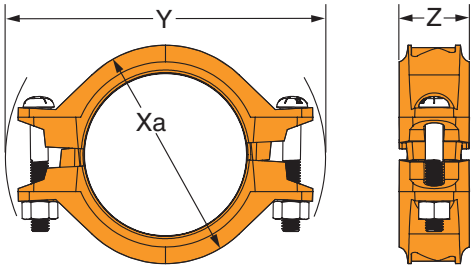


FIGURE 7402 SLIDELOK COUPLING

Nominal Size	O.D.	Max. Working Pressure †	Max. End Load	Range of Pipe End Separation	Coupling Dimensions				Coupling Bolts		Specified Torque §		Approx. Wt. Ea.
					Xa	Xb	Y	Z	Qty.	Size	Min.	Max.	
In./DN(mm)	*In./mm*	*PSI/bar*	*Lbs./kN*	*In./mm*	*In./mm*	*In./mm*	*In./mm*	*In./mm*		*In./mm*	*Ft.-Lbs/N-M*		*Lbs./kg*
2 *50*	2.375 *60.3*	750 *51.7*	3,323 *14.78*	0-1/32 *0-0.79*	3¾ *95*	3⅜ *86*	6 *152*	2 *51*	2	½ x 2¾ *M12 x 70*	80 *110*	100 *150*	2.9 *1.3*
2½ *65*	2.875 *73.0*	750 *51.7*	4,869 *21.66*	0-1/32 *0-0.79*	4⅝ *117*	4¼ *108*	6⅜ *163*	2 *51*	2	½ x 2¾ *M12 x 70*	80 *110*	100 *150*	3.1 *1.4*
3 *80*	3.500 *88.9*	750 *51.7*	7,216 *32.10*	0-1/32 *0-0.79*	5⅕ *132*	4 11/16 *119*	7 *178*	2 *51*	2	½ x 3½ *M12 x 89*	80 *110*	100 *150*	3.6 *1.6*
4 *100*	4.500 *114.3*	750 *51.7*	11,928 *53.06*	0-3/32 *0-2.38*	6½ *165*	6 *152*	8 5/16 *212*	2 *51*	2	½ x 3½ *M12 x 89*	80 *110*	100 *150*	4.9 *2.2*
5 *125*	5.563 *141.3*	750 *51.7*	18,229 *81.09*	0-3/32 *0-2.38*	7¾ *196*	7⅛ *181*	9¾ *248*	2 *51*	2	⅝ x 3½ *M16 x 89*	100 *135*	130 *175*	6.1 *2.8*
6 *150*	6.625 *168.3*	700 *48.3*	24,130 *107.34*	0-3/32 *0-2.38*	8⅞ *224*	8⅕ *208*	10⅘ *274*	2 *51*	2	⅝ x 3½ *M16 x 89*	100 *135*	130 *175*	6.8 *3.1*
8 *200*	8.625 *219.1*	600 *41.4*	35,056 *155.94*	0-3/32 *0-2.38*	11⅜ *289*	10⅝ *270*	13⅜ *340*	2½ *64*	2	¾ x 4½ *M20 x 115*	130 *175*	180 *245*	10.9 *4.9*

NOTES:

Range of Pipe End Separation values are for roll grooved pipe and may be doubled for cut groove pipe.

†Maximum Working Pressure Rating is for schedule 40 steel pipe. For light wall, stainless steel, aluminum and ISO pipe pressure ratings, please refer to the technical data section.

Impact gun can be used for installation, verify that the output of the impact gun is within the required torque range.

Not for use on "EG" rolled or cut grooved pipe ends.

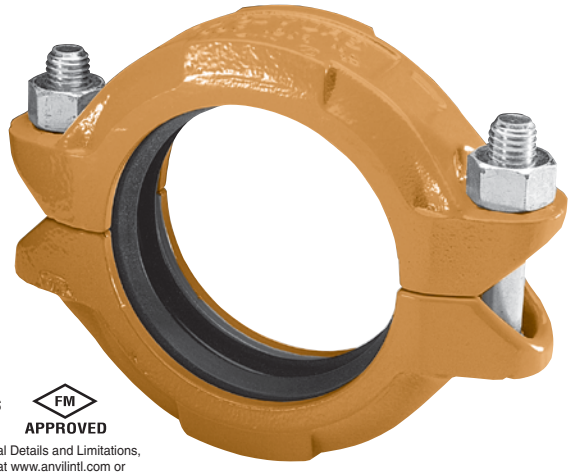
Contact an Anvil Representative for use on light wall and SS pipe applications.

For additional details see "Coupling Data Chart Notes" on page 17.
§ – For additional Bolt Torque information, see page 222.
See Installation & Assembly directions on pages 186-187.
Not for use in copper systems.

FIG. 7001
Flexible Coupling

The Gruvlok® Fig. 7001 Coupling forms a flexible grooved end pipe joint connection with the versatility for a wide range of applications. Services include mechanical and plumbing, process piping, mining and oil field piping, and many others. The coupling design supplies optimum strength for working pressures to 1000 PSI (69 bar) without excessive casting weight.

The flexible design eases pipe and equipment installation while providing the designed-in benefit of reducing pipeline noise and vibration transmission without the addition of special components. To ease coupling handling and assembly and to assure consistent quality, sizes 1" through 14" couplings have two 180° segment housings, 16" have three 120° segment housings, and 18" through 24" sizes have four 90° segment housings, while the 28" O.D. and 30" O.D. couplings have six 60° segment housings. The 28" O.D. and 30" O.D. are weld-ring couplings.



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For Listings/Approval Details and Limitations, visit our website at www.anvilintl.com or contact an Anvil® Sales Representative.

MATERIAL SPECIFICATIONS

BOLTS:
SAE J429, Grade 5, Zinc Electroplated
ISO 898-1, Class 8.8, Zinc Electroplated followed by a Yellow Chromate Dip

HEAVY HEX NUTS:
ASTM A563, Grade A, Zinc Electroplated
ISO 898-2, Class 8.8, Zinc Electroplated followed by a Yellow Chromate Dip

STAINLESS STEEL BOLTS & NUTS:
304SS bolts and nuts are available as a standard option.
(316SS are available for special order).

HOUSING:
Ductile Iron conforming to ASTM A 536, Grade 65-45-12

COATINGS:
Rust inhibiting paint – Color: ORANGE (standard)
Hot Dipped Zinc Galvanized (optional)
Other Colors Available (IE: RAL3000 and RAL9000)
For other Coating requirements contact an Anvil Representative.

GASKETS: Materials
Properties as designated in accordance with ASTM D 2000

Grade "EP" EPDM (Green and Red color code)
-40°F to 250°F (Service Temperature Range)(-40°C to 121°C)
Recommended for water service, diluted acids, alkalies solutions, oil-free air and many other chemical services.
NOT FOR USE IN PETROLEUM APPLICATIONS.

For hot water applications the use of Gruvlok Extreme Temperature lubricant is recommended. NSF-61 Certified for cold and hot water applications up through 12".

Grade "T" Nitrile (Orange color code)
-20°F to 180°F (Service Temperature Range)(-29°C to 82°C)
Recommended for petroleum applications. Air with oil vapors and vegetable and mineral oils.
NOT FOR USE IN HOT WATER OR HOT AIR

Grade "O" Fluoro-Elastomer (Blue color code)
Size Range: 1" - 12" (C style only)
20°F to 300°F (Service Temperature Range)(-29°C to 149°C)
Recommended for high temperature resistance to oxidizing acids, petroleum oils, hydraulic fluids, halogenated hydrocarbons and lubricants.

Grade "L" Silicone (Red color code)
Size Range: 1" - 12" (C style only)
-40°F to 350°F (Service Temperature Range)(-40°C to 177°C)
Recommended for dry, hot air and some high temperature chemical services. Contact an Anvil Representative for availability.

GASKET TYPE:
C Style (1" - 30")
Flush Gap (1" - 24")

LUBRICATION:
Standard
Gruvlok Xtreme™ (Do Not use with Grade "L")

WORKING PRESSURE, END LOAD, PIPE END SEPARATION & DEFLECTION FROM CENTER LINE:
Based on standard wall steel pipe with cut or roll grooves in accordance with Gruvlok specifications. See technical data section for design factors.

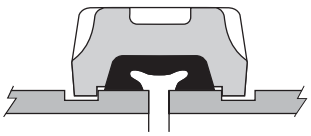


Fig. 7001 with Standard Gasket

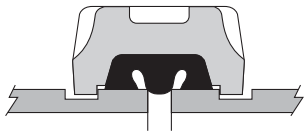
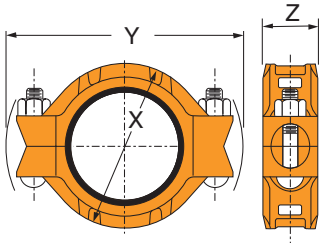


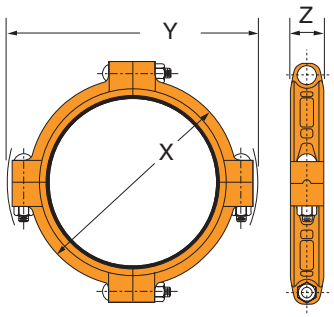
Fig. 7001 with Flush Gap Gasket

FIG. 7001

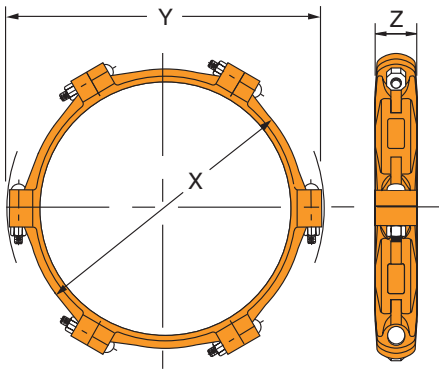
Flexible Coupling



SIZES 1" - 14"



SIZES 16" - 24"



SIZES 28" - 30"

FIGURE 7001 FLEXIBLE COUPLING

Nominal Size	O.D.	Max. Work. Pressure†	Max. End Load	Range of Pipe End Separation	Deflection from ℄		Coupling Dimensions			Bolt Dimensions*		Specified Torque §		Approx. Wt. Ea.
					Per Coupling	of Pipe	X	Y	Z	Qty.	Size	Min.	Max.	
In./DN(mm)	*In./mm*	*PSI/bar*	*Lbs./kN*	*In./mm*	*Degrees(°)-Minutes(')*	*In./ft-mm/m*	*In./mm*	*In./mm*	*In./mm*		*In./mm*	*Ft.-Lbs/N-m*		*Lbs./kg*
1 *25*	1.315 *33.4*	1000 *68.9*	1,358 *6.04*	0-1/32 *0-0.79*	1° 22'	0.29 *23.8*	2½ *64*	4½ *114*	1⅞ *48*	2	⅜ x 2¼ *M10 x 57*	30 *40*	45 *60*	1.3 *0.6*
1¼ *32*	1.660 *42.2*	1000 *68.9*	2,164 *9.63*	0-1/32 *0-0.79*	1° 5'	0.23 *18.8*	2¾ *70*	4½ *114*	1⅞ *48*	2	⅜ x 2¼ *M10 x 57*	30 *40*	45 *60*	1.4 *0.6*
1½ *40*	1.900 *48.3*	1000 *68.9*	2,835 *12.61*	0-1/32 *0-0.79*	0° 57'	0.20 *16.5*	3 *76*	4⅝ *117*	1⅞ *48*	2	⅜ x 2¼ *M10 x 57*	30 *40*	45 *60*	1.5 *0.7*
2 *50*	2.375 *60.3*	1000 *68.9*	4,430 *19.71*	0-1/32 *0-0.79*	0° 45'	0.16 *13.1*	3⅝ *92*	6⅛ *156*	1⅞ *48*	2	½ x 3 *M12 x 76*	80 *110*	100 *150*	3.1 *1.4*
2½ *65*	2.875 *73.0*	1000 *68.9*	6,492 *28.88*	0-1/32 *0-0.79*	0° 37'	0.13 *10.9*	4¼ *108*	6½ *165*	1⅞ *48*	2	½ x 3 *M12 x 76*	80 *110*	100 *150*	3.7 *1.7*
3 O.D. 76.1	*2.996* 76.1	*1000* 68.9	*7,050* 31.36	*0-1/32* *0-0.79*	*0° 36'*	*0.13* 10.4	*4¼* 108	*6¾* 171	*1⅞* 48	*2*	*½ x 3* M12 x 76	*80* 110	*100* 150	*4.3* 2.0
3 *80*	3.500 *88.9*	1000 *68.9*	9,621 *42.80*	0-1/32 *0-0.79*	0° 31'	0.11 *8.9*	4⅞ *124*	7⅛ *181*	1⅞ *48*	2	½ x 3 *M12 x 76*	80 *110*	100 *150*	4.3 *2.0*
3½ *90*	4.000 *101.6*	1000 *68.9*	12,566 *55.90*	0-1/32 *0-0.79*	0° 27'	0.09 *7.8*	5¼ *133*	8¼ *210*	1⅞ *48*	2	⅝ x 3½ *M16 x 89*	100 *135*	130 *175*	5.1 *2.3*
4 *100*	4.500 *114.3*	1000 *68.9*	15,904 *70.75*	0-3/32 *0-2.38*	1° 12'	0.25 *20.8*	6¼ *159*	8¾ *222*	2 *51*	2	⅝ x 3½ *M16 x 89*	100 *135*	130 *175*	6.8 *3.1*
5 *125*	5.563 *141.3*	1000 *68.9*	24,306 *108.12*	0-3/32 *0-2.38*	0° 58'	0.20 *16.8*	7¼ *184*	11¼ *286*	2 *51*	2	¾ x 4½ *M20 x 110*	130 *175*	180 *245*	9.6 *4.4*
6½ O.D. 165.1	*6.500* 165.1	*1000* 68.9	*33,183* 147.61	*0-3/32* *0-2.38*	*0° 50'*	*0.17* 14.4	*8¼* 210	*11¾* 298	*2* 51	*2*	*¾ x 4½* M20 x 110	*130* 175	*180* 245	*11.8* 5.4
6 *150*	6.625 *168.3*	1000 *68.9*	34,472 *153.34*	0-3/32 *0-2.38*	0° 49'	0.17 *14.1*	8⅝ *219*	11¾ *298*	2 *51*	2	¾ x 4½ *M20 x 110*	130 *175*	180 *245*	11.8 *5.4*
8 *200*	8.625 *219.1*	800 *55.2*	46,741 *207.91*	0-3/32 *0-2.38*	0° 37'	0.13 *10.9*	11 *279*	14⅜ *365*	2⅜ *60*	2	⅞ x 5½ *M22 x 140*	180 *245*	220 *300*	21.7 *9.8*
10 *250*	10.750 *273.0*	800 *55.2*	72,610 *322.99*	0-3/32 *0-2.38*	0° 30'	0.11 *8.7*	13⅛ *333*	16⅝ *422*	2⅝ *67*	2	⅞ x 5½ *M22 x 140*	180 *245*	220 *300*	27.0 *12.2*
12 *300*	12.750 *323.9*	800 *55.2*	102,141 *454.35*	0-3/32 *0-2.38*	0° 25'	0.09 *7.3*	15½ *394*	18⅝ *473*	2⅝ *67*	2	⅞ x 6 *M22 x 150*	180 *245*	220 *300*	35.0 *15.9*
14 *350*	14.000 *355.6*	300 *20.7*	46,181 *205.43*	0-3/32 *0-2.38*	0° 23'	0.08 *6.7*	16⅛ *410*	20½ *521*	3 *76*	2	⅞ x 5½ *M22 x 140*	180 *245*	220 *300*	37.0 *16.8*
16 *400*	16.000 *406.4*	300 *20.7*	60,319 *268.31*	0-3/32 *0-2.38*	0° 20'	0.07 *5.9*	18⅛ *460*	22⅞ *581*	3 *76*	4	1 x 4 *	200 -	250 -	50.0 *22.7*
18 *450*	18.000 *457.2*	300 *20.7*	76,341 *339.58*	0-3/32 *0-2.38*	0° 18'	0.06 *5.2*	21⅛ *537*	25⅜ *645*	3⅛ *79*	4	1 x 4 *	200 -	250 -	72.0 *32.7*
20 *500*	20.000 *508.0*	300 *20.7*	94,248 *419.23*	0-3/32 *0-2.38*	0° 16'	0.06 *4.7*	23 *584*	28¼ *718*	3⅛ *79*	4	1⅛ x 4½ *	225 -	275 -	82.0 *37.2*
24 *600*	24.000 *609.6*	300 *20.7*	135,717 *603.70*	0-3/32 *0-2.38*	0° 13'	0.05 *3.9*	27 *686*	32⅜ *822*	3⅛ *79*	4	1⅛ x 4½ *	225 -	275 -	90.0 *40.8*
28" I.D. *733.4*	28.875 *733.4*	150 *10.3*	98,226 *436.93*	0-3/32 *0-2.38*	0° 11'	0.04 *3.2*	33½ *851*	35½ *902*	3⅛ *79*	6	1 x 5½ *	200 -	250 -	105.0 *47.6*
30" I.D. *787.4*	31.00 *787.4*	150 *10.3*	113,215 *503.61*	0-3/32 *0-2.38*	0° 10'	0.04 *3.0*	33¾ *857*	38¼ *972*	3⅝ *92*	6	1 x 5½ *	200 -	250 -	137.0 *62.1*

NOTES:

Range of Pipe End Separation and Angular Deflection values are for roll grooved pipe and may be doubled for cut groove pipe. See page 222 for details. Refer to page 228 for Misalignment & Deflection Calculations and page 229 for Curve Layout Calculations.

†Maximum Working Pressure Rating is for schedule 40 steel pipe. For light wall, stainless steel, aluminum and ISO pipe pressure ratings, please refer to the technical data section.

* Available in ANSI or metric bolt sizes only as indicated.
For additional details see "Coupling Data Chart Notes" on page 17.
§ – For additional Bolt Torque information, see page 222.
See Installation & Assembly directions on page 188.
Not for use in copper systems.

FIG. 7000

Lightweight Flexible Coupling

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For Listings/Approval Details and Limitations, visit our website at www.anvilintl.com or contact an Anvil® Sales Representative.

The Fig. 7000 Lightweight Flexible Coupling is designed for applications where system flexibility is desired.

The Fig. 7000 Coupling is approximately 30% lighter in weight than the Fig. 7001 Coupling, and allows for working pressure ratings up to 600 psi (41.4 bar).

The Figure 7000 Lightweight Flexible Coupling is intended for use in several applications. See Gasket Grade Index for gasket recommendations.

See technical data section for design factors.

MATERIAL SPECIFICATIONS

BOLTS:
SAE J429, Grade 5, Zinc Electroplated
ISO 898-1, Class 8.8, Zinc Electroplated followed by a Yellow Chromate Dip

HEAVY HEX NUTS:
ASTM A563, Grade A, Zinc Electroplated
ISO 898-2, Class 8.8, Zinc Electroplated followed by a Yellow Chromate Dip

STAINLESS STEEL BOLTS & NUTS:
304SS bolts and nuts are available as a standard option.
(316SS are available for special order).

HOUSING:
Ductile Iron conforming to ASTM A 536, Grade 65-45-12

COATINGS:
Rust inhibiting paint – Color: ORANGE (standard)
Hot Dipped Zinc Galvanized (optional)
Other Colors Available (IE: RAL3000 and RAL9000)
For other Coating requirements contact an Anvil Representative.

GASKETS: Materials
Properties as designated in accordance with ASTM D 2000

Grade "EP" EPDM (Green and Red color code)
-40°F to 250°F (Service Temperature Range)(-40°C to 121°C)
Recommended for water service, diluted acids, alkalies solutions, oil-free air and many other chemical services.
NOT FOR USE IN PETROLEUM APPLICATIONS.

For hot water applications the use of Gruvlok Extreme Temperature lubricant is recommended. NSF-61 Certified for cold and hot water applications up through 12".

Grade "T" Nitrile (Orange color code)
20°F to 180°F (Service Temperature Range)(-29°C to 82°C)
Recommended for petroleum applications. air with oil vapors and vegetable and mineral oils.
NOT FOR USE IN HOT WATER OR HOT AIR

Grade "O" Fluoro-Elastomer (Blue color code)
Size Range: 1" - 8" (C style only)
-20°F to 300°F (Service Temperature Range)(-29°C to 149°C)
Recommended for high temperature resistance to oxidizing acids, petroleum oils, hydraulic fluids, halogenated hydrocarbons and lubricants.

Grade "L" Silicone (Red color code)
Size Range: 1" - 8" (C style only)
-40°F to 350°F (Service Temperature Range)(-40°C to 177°C)
Recommended for dry, hot air and some high temperature chemical services.

GASKET TYPE:
Standard C Style (1" - 8")
Flush Gap (1" - 8")

LUBRICATION:
Standard Gruvlok
Gruvlok Xtreme™ (Do Not use with Grade "L")

FIG. 7000

Lightweight Flexible Coupling

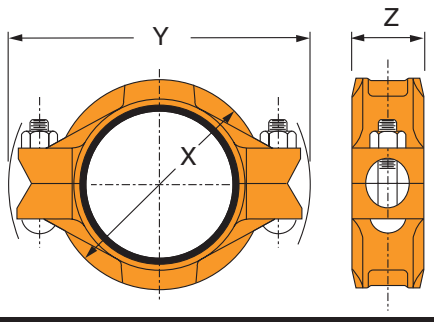


FIGURE 7000 COUPLING

Nominal Size	O.D.	Max. Working Pressure†	Max. End Load	Range of Pipe End Separation	Deflection from ℄		Coupling Dimensions			Coupling Bolts		Specified Torque §		Approx. Wt. Ea.
					Per Coupling	of Pipe	X	Y	Z	Qty.	Size	Min.	Max.	
In./DN(mm)	*In./mm*	*PSI/bar*	*Lbs./kN*	*In./mm*	*Degrees(°)-Minutes(')*	*In./ft-mm/m*	*In./mm*	*In./mm*	*In./mm*		*In./mm*	*Ft.-Lbs./N-m*		*Lbs./Kg*
1 25	1.315 33.4	600 41.4	815 3.62	0-1/32 0-0.79	1° 22'	0.29 23.8	2 3/8 60	4 1/4 108	1 3/4 44	2	3/8 x 2 1/4 M10 x 57	30 40	45 60	1.3 0.6
1 1/4 32	1.660 42.2	600 41.4	1,299 5.78	0-1/32 0-0.79	1° 5'	0.23 18.8	2 3/4 70	4 3/8 111	1 3/4 44	2	3/8 x 2 1/4 M10 x 57	30 40	45 60	1.4 0.6
1 1/2 40	1.900 48.3	600 41.4	1,701 7.57	0-1/32 0-0.79	0° 57'	0.20 16.5	3 76	4 5/8 117	1 3/4 44	2	3/8 x 2 1/4 M10 x 57	30 40	45 60	1.5 0.7
2 50	2.375 60.3	600 41.4	2,658 11.82	0-1/32 0-0.79	0° 45'	0.16 13.1	3 1/2 89	5 1/2 140	1 3/4 44	2	3/8 x 2 1/4 M10 x 57	30 40	45 60	1.7 0.8
2 1/2 65	2.875 73.0	600 41.4	3,895 17.33	0-1/32 0-0.79	0° 37'	0.13 10.9	4 102	5 3/4 146	1 3/4 44	2	3/8 x 2 1/4 M10 x 57	30 40	45 60	1.9 0.9
3 O.D. 76.1	*2.996* 76.1	*600* 41.4	*4,230* 18.82	*0-1/32* *0-0.79*	*0° 36'*	*0.13* 10.4	*4* 102	*6 1/8* 156	*1 3/4* 44	*2*	*3/8 x 2 1/4* M10 x 57	*30* 40	*45* 60	*2.3* 1.0
3 80	3.500 88.9	600 41.4	5,773 25.68	0-1/32 0-0.79	0° 31'	0.11 8.9	4 5/8 117	6 3/4 171	1 3/4 44	2	1/2 x 2 3/4 M12 x 70	80 110	100 150	2.9 1.3
3 1/2 90	4.000 101.6	600 41.4	7,540 33.54	0-1/32 0-0.79	0° 27'	0.09 7.8	5 1/8 130	7 5/8 194	1 3/4 44	2	1/2 x 3 M12 x 76	80 110	100 150	3.1 1.4
4 1/4 O.D. 108.0	*4.250* 108.0	*600* 41.4	*8,512* 37.86	*0-3/32* 0-2.38	*1° 16'*	*0.26* 22.0	*5 1/2* 140	*7 3/4* 197	*2* 51	*2*	*1/2 x 3* M12 x 76	*80* 110	*100* 150	*4.0* 1.8
4 100	4.500 114.3	600 41.4	9,543 42.45	0-3/32 0-2.38	1° 12'	0.25 20.8	5 7/8 149	8 1/8 206	2 51	2	1/2 x 3 M12 x 76	80 110	100 150	4.6 2.1
5 1/4 O.D. 133.0	*5.236* 133.0	*500* 34.5	*10,766* 47.89	*0-3/32* 0-2.38	*1° 2'*	*0.21* 17.9	*6 1/2* 165	*9 1/8* 232	*2* 51	*2*	*5/8 x 3 1/2* M16 x 85	*100* 135	*130* 175	*5.7* 2.6
5 1/2 O.D. 139.7	*5.500* 139.7	*500* 34.5	*11,879* 52.84	*0-3/32* 0-2.38	*0° 59'*	*0.20* 17.0	*6 3/4* 171	*9 3/8* 238	*2* 51	*2*	*5/8 x 3 1/2* M16 x 85	*100* 135	*130* 175	*6* 2.7
5 125	5.563 141.3	500 34.5	12,153 54.06	0-3/32 0-2.38	0° 58'	0.20 16.8	7 178	9 5/8 244	2 51	2	5/8 x 3 1/2 M16 x 85	100 135	130 175	6.1 2.8
6 1/4 O.D. 159.0	*6.259* 159.0	*500* 34.5	*15,384* 68.43	*0-3/32* 0-2.38	*0° 51'*	*0.18* 14.9	*7 1/2* 191	*10 3/8* 264	*2* 51	*2*	*5/8 x 3 1/2* M16 x 85	*100* 135	*130* 175	*6.7* 3.0
6 1/2 O.D. 165.1	*6.500* 165.1	*500* 34.5	*16,592* 73.80	*0-3/32* 0-2.38	*0° 50'*	*0.17* 13.1	*7 3/4* 197	*10 3/4* 273	*2* 51	*2*	*5/8 x 3 1/2* M16 x 85	*100* 135	*130* 175	*7.0* 3.2
6 150	6.625 168.3	500 34.5	17,236 76.67	0-3/32 0-2.38	0° 49'	0.17 14.1	8 203	11 279	2 51	2	5/8 x 3 1/2 M16 x 85	100 135	130 175	8.1 3.7
8 200	8.625 219.1	500 34.5	29,213 129.95	0-3/32 0-2.38	0° 37'	0.13 10.9	10 1/2 264	12 13/16 337	2 1/2 60	2	3/4 x 4 1/2 M20 x 110	130 175	180 245	14.2 6.4

NOTES:

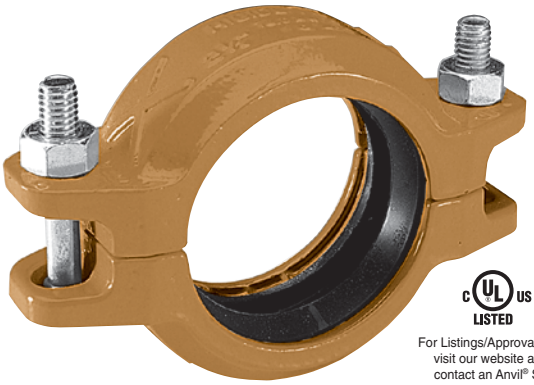
Range of Pipe End Separation and Angular Deflection values are for roll grooved pipe and may be doubled for cut groove pipe. See page 222 for details. Refer to page 228 for Misalignment & Deflection Calculations and page 229 for Curve Layout Calculations.

†Maximum Working Pressure Rating is for schedule 40 steel pipe. For light wall, stainless steel, aluminum and ISO pipe pressure ratings, please refer to the technical data section.

For additional details see "Coupling Data Chart Notes" on page 17.
§ – For additional Bolt Torque information, see page 222.
See Installation & Assembly directions on page 191.
Not for use in copper systems.

FIG. 7400

Rigidlite® Coupling



VdS

DN 50 and DN 200 sizes are VdS approved.

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The Fig. 7400 Rigidlite Coupling from Gruvlok is specially designed to provide a rigid, locked-in pipe connection to meet the specific demands of rigid design steel pipe systems. Fast and easy swing-over installation of the rugged lightweight housing produces a secure, rigid pipe joint.

The Fig. 7400 Rigidlite Coupling is UL/ULC Listed and FM Approved for 300 psi (20.7 bar) with roll grooved or cut grooved steel pipe prepared in accordance with Gruvlok grooving specifications.

The galvanized Fig. 7400 is ideal for stainless steel piping application where the external corrosion properties of stainless steel is not required. For Gruvlok coupling pressure ratings on stainless steel pipe, please refer to page 232.

MATERIAL SPECIFICATIONS

BOLTS:
SAE J429, Grade 5, Zinc Electroplated
ISO 898-1, Class 8.8, Zinc Electroplated followed by a Yellow Chromate Dip

HEAVY HEX NUTS:
ASTM A563, Grade A, Zinc Electroplated
ISO 898-2, Class 8.8, Zinc Electroplated followed by a Yellow Chromate Dip

STAINLESS STEEL BOLTS & NUTS:
304SS bolts and nuts are available as a standard option.
(316SS are available for special order).

HOUSING:
Ductile Iron conforming to ASTM A 536, Grade 65-45-12.

COATINGS:
Rust inhibiting paint – Color: ORANGE (standard)
Hot Dipped Zinc Galvanized (optional)
Other Colors Available (IE: RAL3000 and RAL9000)
For other Coating requirements contact an Anvil Representative.

GASKETS: Materials
Properties as designated in accordance with ASTM D 2000

Grade "EP" EPDM (Green and Red color code)
-40°F to 250°F (Service Temperature Range)(-40°C to 121°C)
Recommended for water service, diluted acids, alkalies solutions, oil-free air and many other chemical services.
NOT FOR USE IN PETROLEUM APPLICATIONS.

For hot water applications the use of Gruvlok Extreme Temperature lubricant is recommended. NSF-61 Certified for cold and hot water applications up through 12".

Grade "T" Nitrile (Orange color code)
-20°F to 180°F (Service Temperature Range)(-29°C to 82°C)
Recommended for petroleum applications. air with oil vapors and vegetable and mineral oils.
NOT FOR USE IN HOT WATER OR HOT AIR

Grade "O" Fluoro-Elastomer (Blue color code)
Size Range: 1" - 8" (C style only)
20°F to 300°F (Service Temperature Range)(-29°C to 149°C)
Recommended for high temperature resistance to oxidizing acids, petroleum oils, hydraulic fluids, halogenated hydrocarbons and lubricants.

Grade "L" Silicone (Red color code)
Size Range: 1" - 8" (C style only)
-40°F to 350°F (Service Temperature Range)(-40°C to 177°C)
Recommended for dry, hot air and some high temperature chemical services.

GASKET TYPE:
Standard C Style (1" - 8")
Flush Gap (1" - 8")

LUBRICATION:
Standard Gruvlok
Gruvlok Xtreme™ (Do Not use with Grade "L")

FIG. 7400

Rigidlite® Coupling

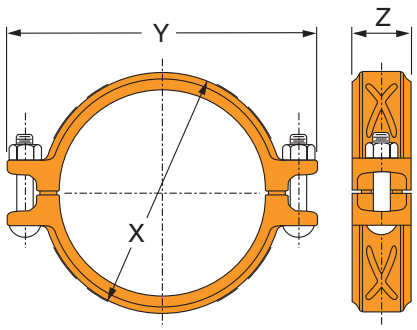


FIGURE 7400 RIGIDLITE COUPLING

Nominal Size	O.D.	Max. Wk. Pressure†	Max. End Load	Range of Pipe End Separation	Coupling Dimensions			Coupling Bolts		Specified Torque §		Approx. Wt. Ea.
					X	Y	Z	Qty.	Size	Min.	Max.	
In./DN(mm)	*In./mm*	*PSI/bar*	*Lbs./kN*	*In./mm*	*In./mm*	*In./mm*	*In./mm*		*In./mm*	*Ft.-Lbs./N-m*		*Lbs./Kg*
1 *25*	1.315 *33.4*	300 *20.7*	407 *1.81*	0-1/32 *0-0.79*	2 1/4 *57*	4 1/2 *114*	1 3/4 *44*	2	3/8 x 2 1/4 *M10 x 57*	30 *40*	45 *60*	1.2 *0.5*
1 1/4 *32*	1.660 *42.2*	300 *20.7*	649 *2.89*	0-1/32 *0-0.79*	2 5/8 *67*	4 3/4 *121*	1 3/4 *44*	2	3/8 x 2 1/4 *M10 x 57*	30 *40*	45 *60*	1.3 *0.6*
1 1/2 *40*	1.900 *48.3*	300 *20.7*	851 *3.78*	0-1/32 *0-0.79*	2 7/8 *73*	4 7/8 *124*	1 3/4 *44*	2	3/8 x 2 1/4 *M10 x 57*	30 *40*	45 *60*	1.4 *0.6*
2 *50**	2.375 *60.3*	300 *20.7*	1,329 *5.91*	0-1/32 *0-0.79*	3 1/4 *83*	5 1/2 *140*	1 3/4 *44*	2	3/8 x 2 1/4 *M10 x 57*	30 *40*	45 *60*	1.6 *0.7*
2 1/2 *65*	2.875 *73.0*	300 *20.7*	1,948 *8.66*	0-1/32 *0-0.79*	3 7/8 *98*	6 *152*	1 3/4 *44*	2	3/8 x 2 1/4 *M10 x 57*	30 *40*	45 *60*	1.9 *0.9*
3 O.D. 76.1	*2.996* 76.1	*300* 20.7	*2,115* 9.41	*0-1/32* 0-0.79	*4* 102	*5 7/8* 149	*1 3/4* 44	*2*	*3/8 x 2 1/4* M10 x 57	*30* 40	*45* 60	*1.9* 0.9
3 *80*	3.500 *88.9*	300 *20.7*	2,886 *12.84*	0-1/32 *0-0.79*	4 1/2 *114*	6 3/4 *171*	1 3/4 *44*	2	3/8 x 2 3/4 *M10 x 70*	30 *40*	45 *60*	2.1 *1.0*
4 *100*	4.500 *114.3*	300 *20.7*	4,771 *21.22*	0-3/32 *0-2.38*	5 5/8 *143*	7 3/4 *197*	1 7/8 *48*	2	3/8 x 2 3/4 *M10 x 70*	30 *40*	45 *60*	3.1 *1.4*
5 1/2 O.D. 139.7	*5.500* 139.7	*300* 20.7	*7,127* 31.70	*0-3/32* 0-2.38	*6 3/4* 171	*9 1/4* 235	*2* 51	*2*	*1/2 x 3* M12 x 76	*80* 110	*100* 150	*4.5* 2.0
5 *125*	5.563 *141.3*	300 *20.7*	7,292 *32.44*	0-3/32 *0-2.38*	6 7/8 *175*	9 1/4 *235*	2 *51*	2	1/2 x 3 *M12 x 76*	80 *110*	100 *150*	4.6 *2.1*
6 1/2 O.D. 165.1	*6.500* 165.1	*300* 20.7	*9,955* 44.28	*0-3/32* 0-2.38	*7 3/4* 200	*10 3/8* 264	*2* 51	*2*	*1/2 x 3* M12 x 76	*80* 110	*100* 150	*5.5* 2.5
6 *150*	6.625 *168.3*	300 *20.7*	10,341 *46.00*	0-3/32 *0-2.38*	7 7/8 *200*	10 3/8 *264*	2 *51*	2	1/2 x 3 *M12 x 76*	80 *110*	100 *150*	5.5 *2.5*
8 *200**	8.625 *219.1*	300 *20.7*	17,528 *77.97*	0-3/32 *0-2.38*	10 1/4 *260*	12 3/4 *324*	2 3/8 *60*	2	1/2 x 3 *M12 x 76*	80 *110*	100 *150*	8.4 *3.8*

NOTE:

Range of Pipe End Seperation values are for roll grooved pipe and may be doubled for cut groove pipe.

†Maximum Working Pressure Rating is for schedule 40 steel pipe. For light wall, stainless steel, aluminum and ISO pipe pressure ratings, please refer to the technical data section.

Other sizes available, contact an Anvil Representative for more information.

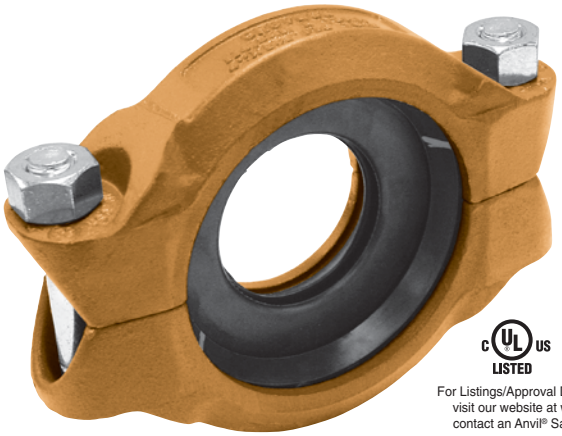
For additional details see "Coupling Data Chart Notes" on page 17.

* DN 50 and DN 200 sizes are VdS approved.

§ – For additional Bolt Torque information, see page 222.

See Installation & Assembly directions on page 192.

FIG. 7010
Reducing Coupling



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The Fig. 7010 Reducing Coupling makes it possible to directly connect two different pipe sizes, eliminating the need for two couplings and a reducing fitting. The specially designed reducing coupling gasket with a center rib assures proper positioning of the gasket and prevents the smaller pipe from telescoping into the larger during assembly. Fig. 7010 Reducing Coupling allows for working pressure ratings up to 500 PSI (34.5 bar). Not recommended for vacuum applications.

MATERIAL SPECIFICATIONS

BOLTS:
SAE J429, Grade 5, Zinc Electroplated
ISO 898-1, Class 8.8, Zinc Electroplated followed by a Yellow Chromate Dip

HEAVY HEX NUTS:
ASTM A563, Grade A, Zinc Electroplated
ISO 898-2, Class 8.8, Zinc Electroplated followed by a Yellow Chromate Dip

HOUSING:
Ductile Iron conforming to ASTM A 536, Grade 65-45-12, or
Malleable Iron conforming to ASTM A 47, Grade 32510.

COATINGS:
Rust inhibiting paint – Color: ORANGE (standard)
Hot Dipped Zinc Galvanized (optional)
Other Colors Available (IE: RAL3000 and RAL9000)
For other Coating requirements contact an Anvil Representative.

GASKETS: Materials
Properties as designated in accordance with ASTM D 2000

Grade "E" EPDM (Green color code)
-40°F to 230°F (Service Temperature Range)(-40°C to 110°C)
Recommended for water service, diluted acids, alkalies solutions, oil-free air and many other chemical services.
NOT FOR USE IN PETROLEUM APPLICATIONS.

Grade "T" Nitrile (Orange color code)
-20°F to 180°F (Service Temperature Range)(-29°C to 82°C)
Recommended for petroleum applications. air with oil vapors and vegetable and mineral oils.
NOT FOR USE IN HOT WATER OR HOT AIR.

LUBRICATION:
Standard Gruvlok
Gruvlok Xtreme™ (Do Not use with Grade "L")

FIG. 7010
Reducing Coupling

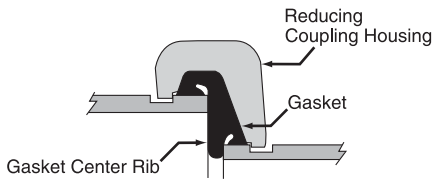


Fig. 7010
Coupling with Gasket

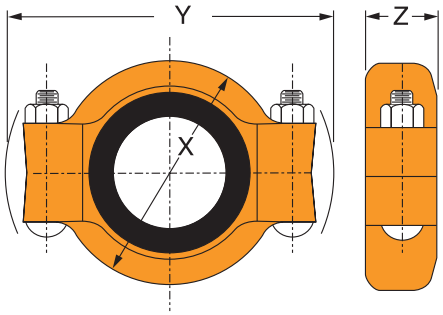


FIGURE 7010 REDUCING COUPLING

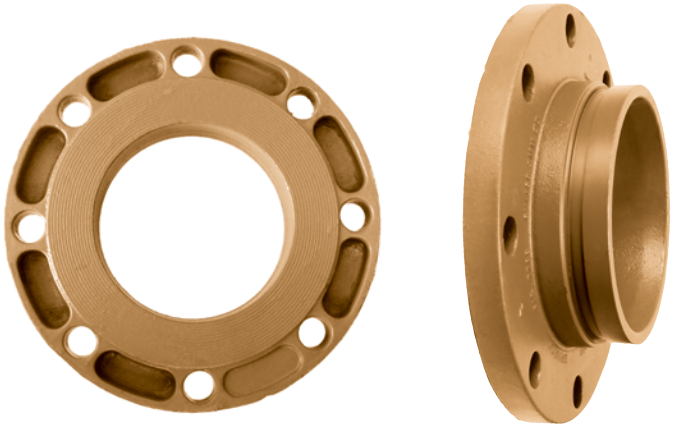
Nominal Size	Larger O.D.	Smaller O.D.	Max. Working Pressure†	Max. End Load	Range of Pipe End Separation	Deflection from ℄		Coupling Dimensions			Coupling Bolts		Specified Torque §		Approx. Wt. Ea.
						Per Coupling	of Pipe	X	Y	Z	Qty.	Size	Min.	Max.	
In./DN(mm)	*In./mm*	*In./mm*	*PSI/bar*	*Lbs./kN*	*In./mm*	*Degrees(°)-Minutes(')*	*In./ft-mm/m*	*In./mm*	*In./mm*	*In./mm*		*In./mm*	*Ft.-Lbs./N-m*		*Lbs./Kg*
2 x 1½ *50 x 40*	2.375 *60.3*	1.900 *48.3*	500 *34.5*	2,215 *9.85*	0-1/32 *0-0.79*	0° 45'	0.16 *13.1*	3 5/8 *92*	5 7/8 *149*	1 7/8 *48*	2	½ x 2¾ *M12 x 76*	80 *110*	100 *150*	2.0 *0.9*
2½ x 2 *65 x 50*	2.875 *73.0*	2.375 *60.3*	500 *34.5*	3,246 *14.44*	0-1/32 *0-0.79*	0° 37'	0.13 *10.9*	4¼ *108*	6 3/8 *162*	1 7/8 *48*	2	½ x 2¾ *M12 x 76*	80 *110*	100 *150*	3.5 *1.6*
3 x 2 *80 x 50*	3.500 *88.9*	2.375 *60.3*	500 *34.5*	4,811 *21.40*	0-1/32 *0-0.79*	0° 31'	0.11 *8.9*	4 7/8 *124*	7 1/8 *181*	1 7/8 *48*	2	½ x 2¾ *M12 x 76*	80 *110*	100 *150*	4.4 *2.0*
3 x 2½ *80 x 65*	3.500 *88.9*	2.875 *73.0*	500 *34.5*	4,811 *21.40*	0-1/32 *0-0.79*	0° 31'	0.11 *8.9*	4 7/8 *124*	7 1/8 *181*	1 7/8 *48*	2	½ x 2¾ *M12 x 76*	80 *110*	100 *150*	4.1 *1.9*
4 x 2 *100 x 50*	4.500 *114.3*	2.375 *60.3*	500 *34.5*	7,952 *35.37*	0-3/32 *0-2.38*	1° 12'	0.25 *20.8*	6¼ *159*	8 7/8 *225*	2 *51*	2	5/8 x 3½ *M16 x 95*	100 *135*	130 *175*	8.9 *4.0*
4 x 2½ *100 x 65*	4.500 *114.3*	2.875 *73.0*	500 *34.5*	7,952 *35.37*	0-3/32 *0-2.38*	1° 12'	0.25 *20.8*	6¼ *159*	8 7/8 *225*	2 *51*	2	5/8 x 3½ *M16 x 95*	100 *135*	130 *175*	7.9 *3.6*
4 x 3 *100 x 80*	4.500 *114.3*	3.500 *88.9*	500 *34.5*	7,952 *35.37*	0-3/32 *0-2.38*	1° 12'	0.25 *20.8*	6¼ *159*	8 7/8 *225*	2 *51*	2	5/8 x 3½ *M16 x 95*	100 *135*	130 *175*	6.7 *3.0*
5 x 4 *125 x 100*	5.563 *141.3*	4.500 *114.3*	500 *34.5*	12,153 *54.06*	0-3/32 *0-2.38*	1° 58'	0.20 *16.8*	7¼ *184*	10 5/8 *270*	2 1/8 *54*	2	¾ x 4½ *M20 x 115*	130 *175*	180 *245*	11.4 *5.2*
6 x 4 *150 x 100*	6.625 *168.3*	4.500 *114.3*	500 *34.5*	17,236 *76.67*	0-3/32 *0-2.38*	0° 49'	0.17 *14.1*	8¼ *210*	11 5/8 *295*	2 1/8 *54*	2	¾ x 4½ *M20 x 115*	130 *175*	180 *245*	13.4 *6.1*
6 x 5 *150 x 125*	6.625 *168.3*	5.562 *141.3*	500 *34.5*	17,236 *76.67*	0-3/32 *0-2.38*	0° 49'	0.17 *14.1*	8½ *216*	11 5/8 *295*	2 1/8 *54*	2	¾ x 4½ *M20 x 115*	130 *175*	180 *245*	13.5 *6.1*
8 x 6 *200 x 150*	8.625 *219.1*	6.625 *168.3*	500 *34.5*	29,213 *129.95*	0-3/32 *0-2.38*	0° 37'	0.13 *10.9*	10½ *267*	14 *356*	2¼ *57*	2	¾ x 4½ *M20 x 115*	130 *175*	180 *245*	17.7 *8.0*

NOTES:
Fig. 7010 Reducing Coupling should not be used with end caps in systems where a vacuum may be developed. Contact your Anvil Representative for details.
Range of Pipe End Separation and Angular Deflection values are for roll grooved pipe and may be doubled for cut groove pipe. See page 222 for details.
Refer to page 228 for Misalignment & Deflection Calculations and page 229 for Curve Layout Calculations.
†Maximum Working Pressure Rating is for schedule 40 steel pipe. For light wall, stainless steel, aluminum and ISO pipe pressure ratings, please refer to the technical data section.

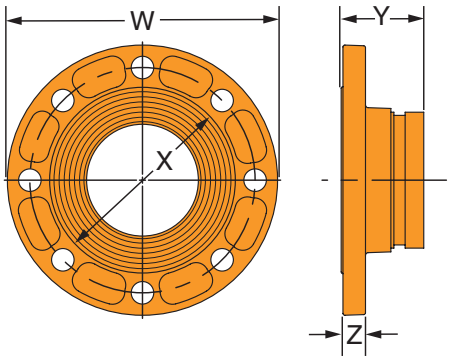
For additional details see "Coupling Data Chart Notes" on page 17.
§ – For additional Bolt Torque information, see page 222.
See Installation & Assembly directions on page 197.
Not for use in copper systems.

FIG. 7788

Gruvlok® Flange Adapter



The Gruvlok Fig. 7788 Flange Adapter allows for direct connection of Class 125 or Class 150 flanged components to a grooved piping system. The Gruvlok Flange Adapter provides an alternative method of connecting to flanged components than the traditional Fig. 7012 Gruvlok Flange. The Gruvlok Flange Adapter provides a raised serrated face flange connection with a shorter overall length than Anvil's Fig. 7084 Flange x Groove Nipple.



MATERIAL SPECIFICATIONS

HOUSING:
Ductile Iron conforming to ASTM A 536, Grade 65-45-12

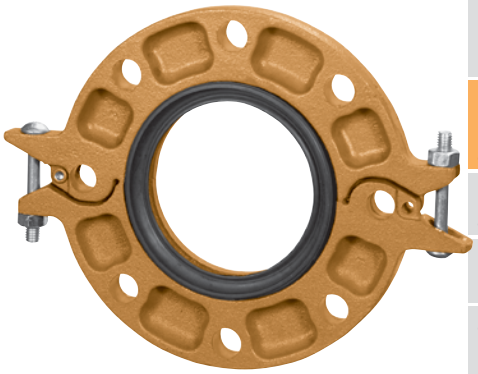
COATINGS:
Rust inhibiting paint – Color: ORANGE (standard), Red (optional)
Hot Dipped Zinc Galvanized (optional)
Other Colors Available (IE: RAL3000 and RAL9000)
For other coating requirements, contact an Anvil Representative for more information.

FIGURE 7788 GRUVLOK FLANGE ADAPTER

Nominal Size	O.D.	Max. Working Pressure	Dimensions				Mating Flange Bolts						Approx. Wt. Ea.
			W	X	Y	Z	Qty.	Size	Bolt Circle Diameter	Bolt Hole Diameter	Specified Torque Min.	Specified Torque Max.	
In./DN(mm)	*In./mm*	*PSI/bar*	*In./mm*	*In./mm*	*In./mm*	*In./mm*	*PN(10) (16)*	*In. (ISO)/mm*	*In./mm*	*In./mm*	*Ft.-Lbs/N-M*		*Lbs./kg*
2 *50*	2.375 *60.3*	300 *20.7*	6 *152.4*	3⅝ *91.9*	2½ *63.5*	11/16 *17.5*	4 *4*	⅝ x 2¾ *M16 x 70*	4¾ *120.7*	¾ *19.1*	110 *149*	140 *190*	4.39 *2.0*
2½ *65*	2.875 *73.0*	300 *20.7*	7 *177.8*	4⅛ *104.6*	2½ *63.5*	¾ *19.1*	4 *4*	⅝ x 2¾ *M16 x 70*	5½ *139.7*	¾ *19.1*	110 *149*	140 *190*	6.17 *2.8*
3 *80*	3.500 *88.9*	300 *20.7*	7½ *190.5*	5 *127.0*	2½ *63.5*	¾ *19.1*	4 *4*	⅝ x 2¾ *M16 x 70*	6 *152.4*	¾ *19.1*	110 *149*	140 *190*	7.19 *3.3*
4 *100*	4.500 *114.3*	300 *20.7*	9 *228.6*	6 3/16 *157.2*	2¾ *69.9*	¾ *19.1*	8 *8*	⅝ x 2¾ *M16 x 70*	7½ *190.5*	¾ *19.1*	110 *149*	140 *190*	10.68 *4.9*
5 *125*	5.563 *141.3*	300 *20.7*	10 *254.0*	7 5/16 *185.7*	2¾ *69.9*	⅞ *22.1*	8 *8*	¾ x 2⅞ *–*	8½ *215.9*	⅞ *22.2*	220 *298*	250 *339*	13.99 *6.4*
6 *150*	6.625 *168.3*	300 *20.7*	11 *279.4*	8½ *215.9*	2¾ *69.9*	⅞ *22.1*	8 *8*	¾ x 3⅛ *M20 x 80*	9½ *241.1*	⅞ *22.2*	220 *298*	250 *339*	16.47 *7.5*
8* *200*	8.625 *219.1*	300 *20.7*	13½ *342.9*	10⅝ *269.7*	3 *76.2*	61/64 *24.1*	8 *8*	¾ x 3¼ *M20 x 80*	11¾ *298.5*	⅞ *22.2*	220 *298*	250 *339*	24.79 *11.3*
10* *250*	10.750 *273.1*	300 *20.7*	16 *406.4*	12¾ *323.9*	3⅜ *85.7*	1 *25.4*	12 *12*	⅞ x 3½ *M20 x 90*	14¼ *362.0*	1 *25.4*	320 *439*	400 *542*	36.75 *16.7*
12* *300*	12.750 *323.9*	300 *20.7*	19 *482.6*	15 *381.0*	3½ *88.9*	1 13/64 *30.5*	12 *12*	⅞ x 3¾ *–*	17 *431.8*	1 *25.4*	320 *439*	400 *542*	56.31 *25.6*

NOTE: 8", 10" and 12" Flange Adapters have a machined raise face. 2" through 6" Flange Adapters have a cast raised face.

FIG. 7012
Gruvlok Flanges



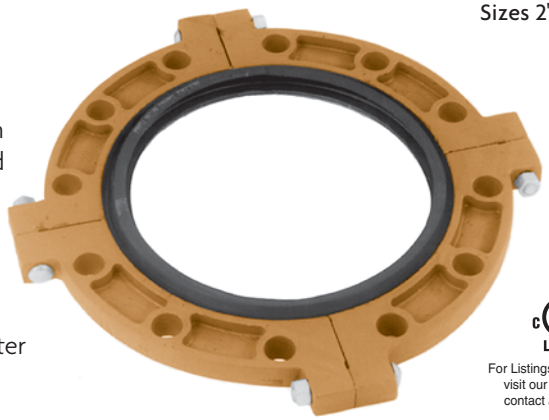
Sizes 2" - 12"

The Gruvlok® Fig. 7012 Flange allows direct connection of Class 125 or Class 150 flanged components to a grooved piping system. The two interlocking halves of the 2" thru 12" sizes of the Gruvlok Flange are hinged for ease of handling, and are drawn together by a latch bolt which eases assembly on the pipe. Precision machined bolt holes, key and mating surfaces assure concentricity and flatness to provide exact fit-up with flanged, lug, and wafer styles of pipe system equipment. A specially designed gasket provides a leak-tight seal on both the pipe and the mating flange face.

The 14" thru 24" sizes of the Gruvlok Fig. 7012 Flange are cast in four segments. A sleek profile gasket design allows quick and easy assembly of the Gruvlok Flange onto the pipe.

All Gruvlok Fig. 7012 Flanges have designed-in anti-rotation tines which bite into and grip the sides of the pipe grooves to provide a secure, rigid connection.

The Gruvlok Fig. 7012 Flange requires the use of a steel adapter insert when used against rubber faced surfaces, wafer/lug design valves and serrated or irregular sealing surfaces. In copper systems a phenolic adapter insert is required, in place of the steel adapter insert. (See Installation and Assembly Instructions Section or contact your Anvil Rep. for details.)



Sizes 14" - 24"

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For Listings/Approval Details and Limitations, visit our website at www.anvilintl.com or contact an Anvil® Sales Representative.

MATERIAL SPECIFICATIONS

LATCH BOLT (2" - 12"), SEGMENT BOLT (14" - 24"):
SAE J429, Grade 5, Zinc Electroplated
ISO 898-1, Class 8.8, Zinc Electroplated followed by a Yellow Chromate Dip

LATCH NUT (2" - 12"), SEGMENT NUT (14" - 24"):
ASTM A563, Grade A, Zinc Electroplated
ISO 898-2, Class 8.8, Zinc Electroplated followed by a Yellow Chromate Dip

HOUSING:
Ductile Iron conforming to ASTM A 536, Grade 65-45-12.

COATINGS:
Rust inhibiting paint – Color: ORANGE (standard), Red (optional)
Hot Dipped Zinc Galvanized (optional)
Other Colors Available (IE: RAL3000 and RAL9000)
For other Coating requirements contact an Anvil Representative.

GASKETS: Materials
Properties as designated in accordance with ASTM D 2000

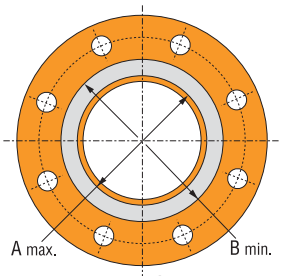
Grade "E" EPDM (Green color code)
-40°F to 230°F (Service Temperature Range)(-40°C to 110°C)
Recommended for water service, diluted acids, alkalies solutions, oil-free air and many other chemical services.
NOT FOR USE IN PETROLEUM APPLICATIONS.

Grade "T" Nitrile (Orange color code)
-20°F to 180°F (Service Temperature Range)(-29°C to 82°C)
Recommended for petroleum applications. air with oil vapors and vegetable and mineral oils.
NOT FOR USE IN HOT WATER.

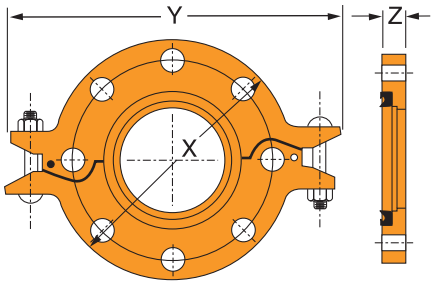
LUBRICATION:
Standard Gruvlok
Gruvlok Xtreme™ (Do Not use with Grade "L")

FIG. 7012

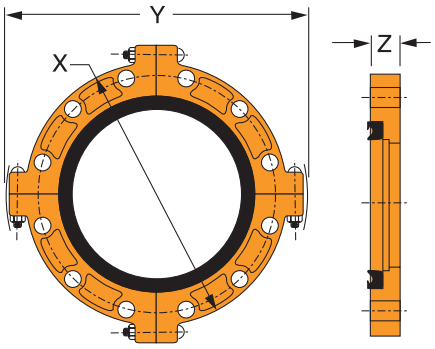
Gruvlok Flanges



Mating Flange



2"-12" sizes



14"-24" sizes

GRUVLOK FIGURE 7012 FLANGE: ANSI CLASS 150 OR ISO PN10 OR PN16 BOLT PATTERNS

Nominal Size	O.D.	Max. Working Pressure†	Max. End Load▼	Latch Bolt			Dimensions			Sealing Surface		Mating Flange Bolts						Approx. Wt. Ea.
				Latch Bolt Size*	Specified Torque §		X	Y	Z	A Max.	B Min.	Mating Flange Bolts		Bolt Circle Diameter	Bolt Hole Diameter	Specified Torque §		
					Min.	Max.						Qty. ANSI	Size (ANSI)			Min.	Max.	
In./DN(mm)	*In./mm*	*PSI/bar*	*Lbs./kN*	*In./mm*	*Ft.-Lbs/N-m*		*In./mm*	*In./mm*	*In./mm*	*In./mm*	*In./mm*	*PN10 (16)*	*in. (ISO) mm*	*In./mm*	*In./mm*	*Ft.-Lbs/N-m*		*Lbs./Kg*
2	2.375	300	1,329	⅜ x 2¾	30	45	6¼	8⅜	¾	2⅜	3⁷⁄₁₆	4	⅝ x 2¾	4¾	¾	110	140	4.2
50	*60.3*	*20.7*	*5.91*	*M10 x 70*	*40*	*60*	*159*	*213*	*19*	*60*	*87*	*4*	*M16 x 70*	*120.7*	*19.1*	*149*	*190*	*1.9*
2½	2.875	300	1,948	⅜ x 2¾	30	45	7	9½	¾	2⅞	4	4	⅝ x 2¾	5½	¾	110	140	4.6
65	*73.0*	*20.7*	*8.66*	*M10 x 70*	*40*	*60*	*178*	*241*	*19*	*73*	*102*	*-*	*M16 x 70*	*139.7*	*19.1*	*149*	*190*	*2.1*
3 O.D.	*2.996*	*300*	*2,115*	*-*	*30*	*45*	*7¼*	*9¾*	*¾*	*3*	*4⅛*	*-*	*-*	*-*	*-*	*110*	*140*	*4.8*
76.1	76.1	20.7	9.41	M10 x 70	40	60	184	248	19	76	105	4	M16 x 70	-	-	149	190	2.2
3	3.500	300	2,886	⅜ x 2¾	30	45	7⅞	10½	¾	3½	4⁹⁄₁₆	4	⅝ x 2¾	6	¾	110	140	6.0
88.9	*88.9*	*20.7*	*12.84*	*M10 x 70*	*40*	*60*	*200*	*267*	*19*	*89*	*116*	*8*	*M16 x 70*	*152.4*	*19.1*	*149*	*190*	*2.7*
4	4.500	300	4,771	⅜ x 2¾	30	45	9	11½	¾	4½	5⁹⁄₁₆	8	⅝ x 2¾	7½	¾	110	140	6.3
100	*114.3*	*20.7*	*21.22*	*M10 x 70*	*40*	*60*	*229*	*292*	*19*	*114*	*141*	*8*	*M16 x 70*	*190.5*	*19.1*	*149*	*190*	*2.9*
5½ O.D.	*5.500*	*300*	*7,127*	*-*	*30*	*45*	*9⅞*	*12⅞*	*⅞*	*5⁹⁄₁₆*	*6¾*	*-*	*-*	*-*	*-*	*220*	*250*	*15.6*
139.7	139.7	20.7	31.70	M10 x 70	40	60	251	327	22	141	171	8	M16 x 75	-	-	298	339	7.1
5	5.563	300	7,292	⅜ x 2¾	30	45	10	12½	⅞	5⁹⁄₁₆	6¾	8	¾ x 2⅞	8½	⅞	220	250	8.8
125	*141.3*	*20.7*	*32.44*	*M10 x 70*	*40*	*60*	*254*	*318*	*22*	*141*	*171*	*-*	*-*	*215.9*	*22.2*	*298*	*339*	*4.0*
6½ O.D.	*6.500*	*300*	*9,955*	*-*	*30*	*45*	*11¼*	*14*	*⅞*	*6⅝*	*7¹³⁄₁₆*	*-*	*-*	*-*	*-*	*220*	*250*	*9.7*
165.1	165.1	20.7	44.28	M10 x 70	40	60	286	356	22	168	198	8	M20 x 80	-	-	298	339	4.4
6	6.625	300	10,341	⅜ x 2¾	30	45	11	14	⅞	6⅝	7¹³⁄₁₆	8	¾ x 3⅛	9½	⅞	220	250	9.6
150	*168.3*	*20.7*	*46.00*	*M10 x 70*	*40*	*60*	*279*	*356*	*22*	*168*	*198*	*8*	*M20 x 80*	*241.1*	*22.2*	*298*	*339*	*4.4*
8	8.625	300	17,528	⅜ x 2¾	30	45	13½	16½	1	8⅝	10	8	¾ x 3¼	11¾	⅞	220	250	15.6
200	*219.1*	*20.7*	*77.97*	*M10 x 70*	*40*	*60*	*343*	*419*	*25*	*219*	*254*	*8 (12)*	*M20 x 80*	*298.5*	*22.2*	*298*	*339*	*7.1*
10	10.750	300	27,229	⅜ x 2¾	30	45	16	19	1	10¾	12⅛	12	⅞ x 3½	14¼	1	320	400	18.2
250	*273.1*	*20.7*	*121.12*	*M10 x 70*	*40*	*60*	*406*	*483*	*25*	*273*	*308*	*12*	*M20 x 90*	*362.0*	*25.4*	*439*	*542*	*8.3*
12	12.750	300	38,303	⅜ x 2¾	30	45	19	21¾	1¼	12¾	14⅛	12	⅞ x 3¾	17	1	320	400	29.9
300	*323.9*	*20.7*	*170.38*	*M10 x 70*	*40*	*60*	*483*	*552*	*32*	*324*	*359*	*12*	*-*	*431.8*	*25.4*	*439*	*542*	*13.6*
14	14.000	300	46,181	⅝ x 4¼	100	130	21	24	1½	14	16	12	1 x 4¼	18¾	1⅛	360	520	52.5
350	*355.6*	*20.7*	*205.43*	*-*	*136*	*176*	*533*	*610*	*38*	*356*	*406*	*-*	*-*	*476.3*	*28.6*	*488*	*705*	*23.8*
16	16.000	300	60,319	⅝ x 4¼	100	130	23½	26½	1½	16	18	16	1 x 4¼	21¼	1⅛	360	520	67.0
400	*406.4*	*20.7*	*268.31*	*-*	*136*	*176*	*597*	*673*	*38*	*406*	*457*	*-*	*-*	*539.8*	*28.6*	*488*	*705*	*30.4*
18	18.000	300	76,341	¾ x 5	130	180	25	29	1⅝	18	20	16	1⅛ x 4¾	22¾	1¼	450	725	82.5
450	*457.2*	*20.7*	*339.58*	*-*	*176*	*244*	*635*	*737*	*41*	*457*	*508*	*-*	*–*	*577.9*	*31.8*	*610*	*983*	*37.4*
20	20.000	300	94,248	¾ x 5	130	180	27½	31½	1¾	20	22	20	1⅛ x 4¾	25	1¼	450	725	106.5
500	*508.0*	*20.7*	*419.23*	*-*	*176*	*244*	*699*	*800*	*44*	*508*	*559*	*-*	*–*	*635.0*	*31.8*	*610*	*983*	*48.3*
24	24.000	250	113,097	⅞ x 5½	180	220	32	36½	1⅞	24	26	20	1¼ x 5½	29½	1⅜	620	1,000	138.5
600	*609.6*	*17.2*	*503.08*	*-*	*244*	*298*	*813*	*927*	*48*	*610*	*660*	*-*	*-*	*749.3*	*34.92*	*841*	*1,356*	*62.8*

NOTES:

†Maximum Working Pressure Rating is for schedule 40 steel pipe. For light wall, stainless steel, aluminum and ISO pipe pressure ratings, please refer to the technical data section.

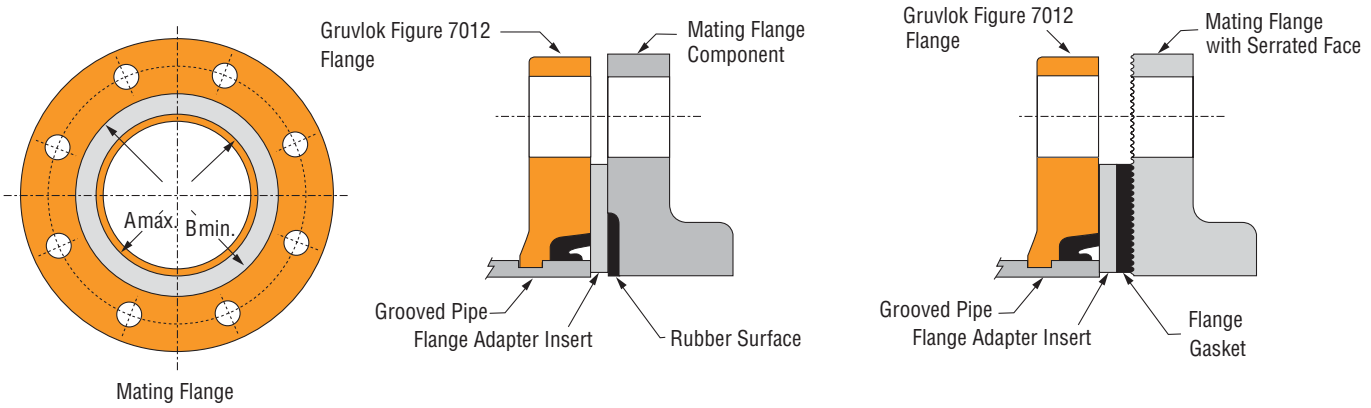
The Gruvlok Flange bolt hole pattern conforms to ANSI Class 150 and Class 125 flanges.

To avoid interference issues, flanges cannot be assembled directly to Series 7700 butterfly valve. Flange can be assembled to one side of series 7500 and 7600 valve only.

Mating flange bolts must be at least Intermediate Strength Bolting per ASME B16.5. Bolts with material properties equal or greater than SAE J429 Grade 5 are acceptable.

For additional details see "Coupling Data Chart Notes" on page 17.
+ PN 16 uses M24 x 90 (PN) Dimensions for bolt circle PN 10 & 16 Flange.
* Available in ANSI or metric bolt sizes only as indicated.
▼ Based on use with standard wall pipe.
§ – For additional Bolt Torque information, see page 222.
See Installation & Assembly directions on page 198-200.

FIG. 7012
Gruvlok Flanges



A. The sealing surfaces A Max. to B Min. of the mating flange must be free from gouges, undulations and deformities of any type to ensure proper sealing of the gasket.

B. Gruvlok Flanges are to be assembled on butterfly valves so as not to interfere with actuator or handle operation.

C. Do not use Gruvlok Flanges within 90 degrees of one another on standard fittings because the outside dimensions may cause interference.

D. Gruvlok Flanges should not be used as anchor points for tierods across non-restrained joints.

E. Fig. 7012 Gruvlok Flange sealing gaskets require a hard flat surface for adequate sealing. The use of a Gruvlok Flange Adapter Insert is required for applications against rubber faced valves or other equipment. The Gruvlok Flange Adapter Insert is installed between the Gruvlok Flange sealing gasket and the mating flange or surface to provide a good sealing surface area.

F. Gruvlok Flanges are not recommended for use against formed rubber flanges.

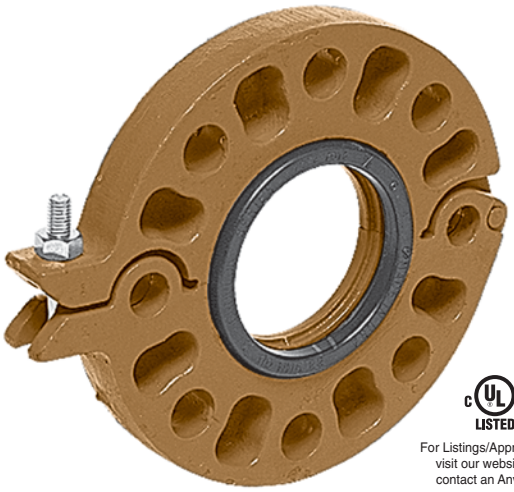
G. Contact an Anvil Representative for Di-Electric Flange connections.

Applications which require a Gruvlok Flange Adapter Insert (page 49):

1. When mating to a wafer valve (lug valve), if the valve is rubber faced in the area designated by the sealing surface dimensions (A Max. to B Min.), place the Gruvlok Flange Adapter Insert between the valve and the Gruvlok flange.
2. When mating to a rubber-faced metal flange, the Gruvlok Flange Adapter Insert is placed between the Gruvlok Flange and the rubber-faced flange.
3. When mating to a serrated flange surface, a standard full-faced flange gasket is installed against the serrated flange face and the Gruvlok Flange Adapter Insert is placed between the Gruvlok Flange and the standard Flange gasket.
4. When mating to valves or other component equipment where the flange face has an insert, use procedure described in note 3.

FIG. 7013

Gruvlok Flanges (300# Flange)



The Gruvlok Fig. 7013 300# Flange allows direct connection of Class 250 or Class 300 flanged components to a Gruvlok piping system. The two halves of the 2" thru 12" sizes of both Gruvlok Flanges are drawn together by a latch bolt which eases assembly on the pipe. A specially designed gasket provides a leak-tight seal on both the pipe and the mating flange face.

Gruvlok Flanges have designed-in anti-rotation tines which bite into and grip the side of the pipe groove to provide a secure, rigid connection.

Gruvlok flange adapter insert required when mating to rubber surfaces or serrated faced mating flanges.

*** The 7013 Gruvlok adapter flange should not be used with the 78FP or 7800 check valve.**

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For Listings/Approval Details and Limitations, visit our website at www.anvilintl.com or contact an Anvil® Sales Representative.

MATERIAL SPECIFICATIONS

BOLTS:
SAE J429, Grade 5, Zinc Electroplated
ISO 898-1, Class 8.8, Zinc Electroplated followed by a Yellow Chromate Dip

HEAVY HEX NUTS:
ASTM A563, Grade A, Zinc Electroplated
ISO 898-2, Class 8.8, Zinc Electroplated followed by a Yellow Chromate Dip

HOUSING:
Ductile Iron conforming to ASTM A 536, Grade 65-45-12.

COATINGS:
Rust inhibiting paint – Color: ORANGE (standard)
Hot Dipped Zinc Galvanized (optional)
Other Colors Available (IE: RAL3000 and RAL9000)
For other Coating requirements contact an Anvil Representative.

GASKETS: Materials
Properties as designated in accordance with ASTM D 2000

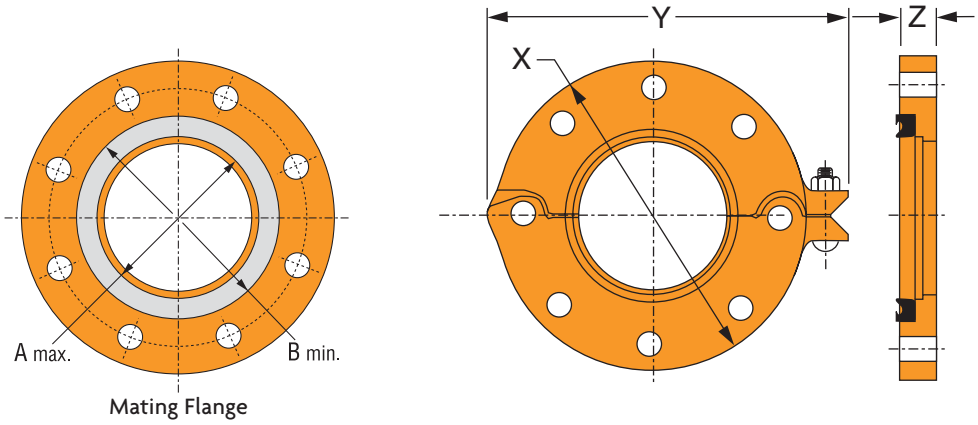
Grade "E" EPDM (Green color code)
-40°F to 230°F (Service Temperature Range)(-40°C to 110°C)
Recommended for water service, diluted acids, alkalies solutions, oil-free air and many other chemical services.
NOT FOR USE IN PETROLEUM APPLICATIONS.

Grade "T" Nitrile (Orange color code)
-20°F to 180°F (Service Temperature Range)(-29°C to 82°C)
Recommended for petroleum applications. air with oil vapors and vegetable and mineral oils.
NOT FOR USE IN HOT WATER OR HOT AIR.

LUBRICATION:
Standard Gruvlok
Gruvlok Xtreme™ (Do Not use for Grade "L")

FIG. 7013

Gruvlok Flanges (300# Flange)



GRUVLOK FIGURE 7013 FLANGE: ANSI CLASS 250 AND 300 BOLT PATTERN

Nominal Size	O.D.	Max. Wk. Pressure†	Max. End Load ▼	Latch* Bolt Size	Specified Torque §		Dimensions			Sealing Surface		Mating Flange Bolts				Approx. Wt. Ea.
					Min.	Max.	X	Y	Z	A Max.	B Min.	Qty. ANSI	Size (ANSI) in.	Bolt Circle Dia.	Bolt Hole Dia.	
In./DN(mm)	*In./mm*	*PSI/bar*	*Lbs./kN*	*In.*	*Ft.-Lbs/N-m*		*In./mm*	*In./mm*	*In./mm*	*In./mm*	*In./mm*		*(ISO) mm*	*In./mm*	*In./mm*	*Lbs./Kg*
2 *50*	2.375 *60.3*	750 *51.7*	3,323 *14.78*	⅜ x 2½ -	30 -	45 -	6½ *165*	8 *203*	1 *25*	2⅜ *60*	3 7/16 *87*	8 -	⅝ x 3 -	5 *127.0*	¾ *19.1*	5.0 *2.3*
2½ *65*	2.875 *73.0*	750 *51.7*	4,869 *21.66*	⅜ x 2½ -	30 -	45 -	7½ *191*	9⅛ *232*	1 *25*	2⅞ *73*	4 *102*	8 -	¾ x 3¼ -	5⅞ *149.2*	⅞ *22.2*	6.9 *3.1*
3 *80*	3.500 *88.9*	750 *51.7*	7,216 *32.10*	⅜ x 2½ -	30 -	45 -	8¼ *210*	9⅞ *251*	1⅛ *29*	3½ *89*	4 9/16 *116*	8 -	¾ x 3½ -	6⅝ *168.3*	⅞ *22.2*	9.4 *4.3*
4 *100*	4.500 *114.3*	750 *51.7*	11,928 *53.06*	⅜ x 2½ -	30 -	45 -	10 *254*	11⅜ *289*	1¼ *32*	4½ *114*	5⅝ *143*	8 -	¾ x 3¾ -	7⅞ *200.0*	⅞ *22.2*	14.4 *6.5*
5 *125*	5.563 *141.3*	750 *51.7*	18,229 *81.09*	⅜ x 2½ -	30 -	45 -	11 *279*	12⅝ *321*	1⅜ *35*	5 9/16 *141*	6¾ *171*	8 -	¾ x 4½ -	9¼ *235.0*	⅞ *22.2*	18.3 *8.3*
6 *150*	6.625 *168.3*	750 *51.7*	25,854 *115.00*	⅜ x 2½ -	30 -	45 -	12½ *318*	14⅛ *359*	1½ *38*	6⅝ *168*	7 13/16 *198*	12 -	¾ x 4½ -	10⅝ *269.9*	⅞ *22.2*	24.9 *11.3*
8 *200*	8.625 *219.1*	750 *51.7*	43,820 *194.92*	½ x 3½ -	80 -	100 -	15 *381*	16⅞ *429*	1⅝ *41*	8⅝ *219*	10 *254*	12 -	⅞ x 4¾ -	13 *330.2*	1 *25.4*	35.4 *16.1*
10 *250*	10.750 *273.1*	750 *51.7*	68,072 *302.80*	½ x 3½ -	80 -	100 -	17½ *445*	19⅜ *492*	1⅞ *48*	10¾ *273*	12⅛ *308*	16 -	1 x 5 -	15¼ *387.4*	1⅛ *28.6*	54.0 *24.5*
12 *300*	12.750 *323.9*	600 *41.4*	76,605 *333.79*	½ x 3½ -	80 -	100 -	20½ *521*	22½ *572*	2 *51*	12¾ *324*	14 3/16 *360*	16 -	1⅛ x 5¾ -	17¾ *450.9*	1¼ *31.8*	74.8 *33.9*

NOTES:

†Maximum Working Pressure Rating is for schedule 40 steel pipe. For light wall, stainless steel, aluminum and ISO pipe pressure ratings, please refer to the technical data section.

Effective sealing area of mating flange must be free from gouges, undulations or deformities of any type to ensure proper sealing of the gasket.

Flange cannot be assembled directly to Series 7700 butterfly valve. Flange can be assembled to one side of series 7500 and 7600 valve.

For additional details see "Coupling Data Chart Notes" on page 17.

* Available in ANSI or metric bolt sizes only as indicated.

▼ Based on use with standard wall pipe.

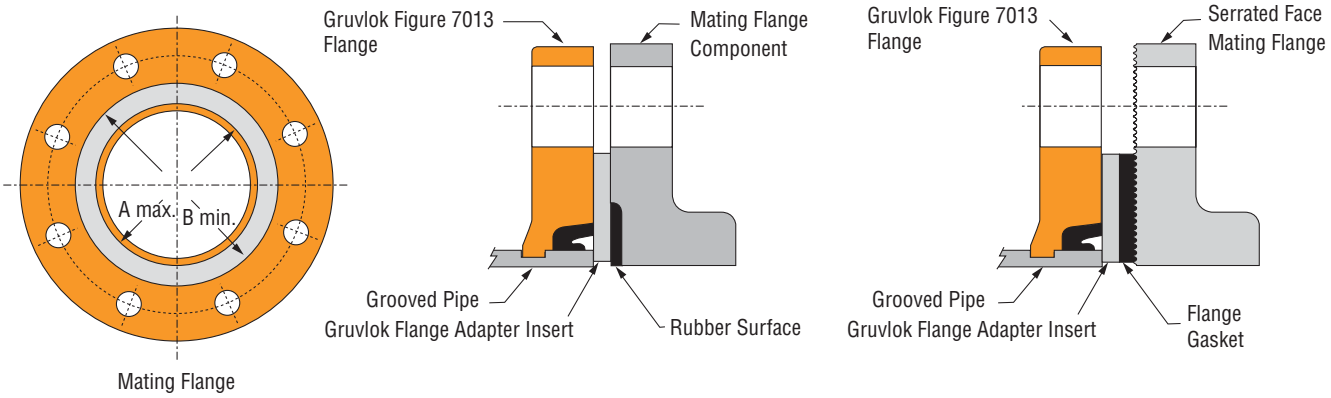
§ – For additional Bolt Torque information, see page 222.

See Installation & Assembly directions or contact your Anvil Representative

Not for use with copper systems.

FIG. 7013

Gruvlok Flanges (300# Flange)



A. The sealing surfaces A Max. to B Min. of the mating flange must be free from gouges, undulations and deformities of any type to ensure proper sealing of the gasket.

B. Gruvlok Flanges are to be assembled on butterfly valves so as not to interfere with actuator or handle operation.

C. Do not use Gruvlok Flanges within 90 degrees of one another on standard fittings because the outside dimensions may cause interference.

D. Gruvlok Flanges should not be used as anchor points for tierods across non-restrained joints.

E. Fig. 7013 Gruvlok Flange sealing gaskets require a hard flat surface for adequate sealing. The use of a Gruvlok Flange Adapter Insert is required for applications against rubber faced valves or other equipment. The Gruvlok Flange Adapter Insert is installed between the Gruvlok Flange sealing gasket and the mating flange or surface to provide a good sealing surface area.

F. Gruvlok Flanges are not recommended for use against formed rubber flanges.

G. Contact an Anvil Representative for Di-Electric Flange connections.

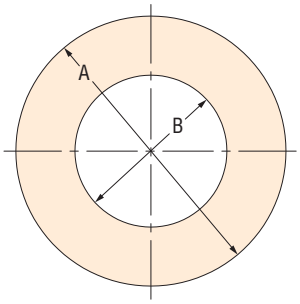
Applications which require a Gruvlok Flange Adapter Insert (page 49):

1. When mating to a wafer valve (lug valve), if the valve is rubber faced in the area designated by the sealing surface dimensions (A Max. to B Min.), place the Gruvlok Flange Adapter Insert between the valve and the Gruvlok flange.
2. When mating to a rubber-faced metal flange, the Gruvlok Flange Adapter Insert is placed between the Gruvlok Flange and the rubber-faced flange.
3. When mating to a serrated flange surface, a standard fullfaced flange gasket is installed against the serrated flange face and the Gruvlok Flange Adapter Insert is placed between the Gruvlok Flange and the standard Flange gasket.
4. When mating to valves or other component equipment where the flange face has an insert, use procedure described in note 3.

FLANGED SEAL RINGS

Flange Adapter Inserts for use with Fig. 7012/7013 Flanges

The Gruvlok flange adapter insert is designed for use with the Gruvlok 7012 & 7013. The flange adapter is required when mating the Gruvlok 7012 & 7013 to a rubber line valve or serrated face flange surface. The flange adapter ring is used in combination with a rubber lined valve or flange gasket to provide a smooth sealing surface for the 7012 & 7013 flange gasket.



MATERIAL SPECIFICATIONS

Carbon steel conforming to ASTM A 1011
Carbon steel rings come zinc electroplated standard
Ring thickness: 0.120" (all sizes and styles)

FLANGED SEAL RINGS

Nominal Size	O.D.	Fig. 7012 ANSI		Fig. 7012 PN 10/16			Fig. 7013 ANSI	
		A	B	PN	A	B	A	B
In./DN(mm)	*In./mm*	*In./mm*	*In./mm*	–	*In./mm*	*In./mm*	*In./mm*	*In./mm*
2 *50*	2.375 *60.3*	4 *102*	2¼ *57*	10/16	*4 11/64* 106	*2¼* 57	4⅛ *105*	100 *150*
2½ *65*	2.875 *73.0*	4¾ *121*	2¾ *70*	–	– –	– –	5 *127*	100 *150*
3 O.D. 76.1	*2.996* 76.1	– –	– –	10/16	*4 31/32* 126	*2⅞* 73	– –	– –
3 *88.9*	3.500 *88.9*	5¼ *133*	3⅜ *86*	10/16	*5 35/64* 141	*3⅜* 89	5¾ *146*	100 *150*
4 *100*	4.500 *114.3*	6¾ *171*	4⅜ *111*	10/16	*6 11/32* 161	*4⅜* 111	7 *178*	130 *175*
5½ O.D. 139.7	*5.500* 139.7	– –	– –	10/16	*7 33/64* 191	*5⅜* 137	– –	– –
5 *125*	5.563 *141.3*	7⅝ *194*	5 7/16 *138*	–	– –	– –	8⅜ *213*	130 *175*
6½ O.D. 165.1	*6.500* 165.1	– –	– –	10/16	*8 33/64* 216	*6⅜* 162	– –	– –
6 *150*	6.625 *168.3*	8⅝ *219*	6½ *165*	10/16	*8 33/64* 216	*6⅜* 162	9¾ *248*	6½ *165*
8 *200*	8.625 *219.1*	10⅞ *276*	8½ *216*	10/16	*10 31/32* 272	*8½* 216	12 *305*	8½ *216*
10 *250*	10.750 *273.1*	13¼ *337*	10⅝ *270*	10/16	*12⅞* 327	*10⅝* 270	14⅛ *359*	8½ *216*
12 *300*	12.750 *323.9*	16 *406*	12⅝ *321*	–	– –	– –	16½ *419*	8½ *216*
12 (PN10) 300	*12.750* 323.9	– –	– –	10	*14 21/32* 377	*12⅝* 321	– –	– –
12 (PN16) 300	*12.750* 323.9	– –	– –	16	*15 5/64* 383	*12⅝* 321	– –	– –
14 *350*	14.000 *355.6*	17⅝ *448*	13¾ *349*	–	– –	– –	– –	– –
16 *400*	16.000 *406.4*	20⅛ *511*	15¾ *400*	–	– –	– –	– –	– –
18 *450*	18.000 *457.2*	21½ *546*	17¾ *451*	–	– –	– –	– –	– –
20 *500*	20.000 *508.0*	23¾ *603*	19¾ *502*	–	– –	– –	– –	– –
24 *600*	24.000 *609.6*	28⅛ *714*	23¾ *603*	–	– –	– –	– –	– –

GRUVLOK FITTINGS FOR GROOVED-END PIPE

Gruvlok fittings are available through 24" nominal pipe size in a variety of styles. Use the Fitting Size Table to convert nominal pipe size to corresponding pipe O.D.

These fittings are designed to provide minimum pressure drop and uniform strength.

Depending on styles and size, Gruvlok fittings are provided in various materials including ductile iron, forged steel or fabricated steel.

Pressure ratings of Gruvlok standard fittings conform to those of Fig. 7001 Gruvlok coupling.

Not for use in copper systems.

NSF/ANSI 61 UPC

Galvanized Gruvlok Fittings are NSF-61 and Low Lead Approved

c UL us LISTED FM APPROVED

For Listings/Approval Details and Limitations, visit our website at www.anvilintl.com or contact an Anvil® Sales Representative.

FLOW DATA – FRICTIONAL RESISTANCE (EXPRESSED AS EQUIVALENT STRAIGHT PIPE)

Nom. Size	O.D.	Pipe Wall Thickness	Elbow		Tee	
			90°	45°	Branch	Run
In./DN(mm)	*In./mm*	*In./mm*	*Ft./m*	*Ft./m*	*Ft./m*	*Ft./m*
1 *25*	1.315 *33.4*	0.133 *3.4*	1.7 *0.5*	0.9 *0.3*	4.4 *1.3*	1.7 *0.5*
1¼ *32*	1.660 *42.2*	0.140 *3.6*	2.3 *0.7*	1.2 *0.4*	5.8 *1.8*	2.3 *0.7*
1½ *40*	1.900 *48.3*	0.145 *3.7*	2.7 *0.8*	1.3 *0.4*	6.7 *2.0*	2.7 *0.8*
2 *50*	2.375 *60.3*	0.154 *3.9*	3.4 *1.0*	1.7 *0.5*	8.6 *2.6*	3.4 *1.0*
2½ *65*	2.875 *73.0*	0.203 *5.2*	4.1 *1.2*	2.1 *0.6*	10.3 *3.1*	4.1 *1.2*
3 O.D. 76.1	*2.996* 76.1	*0.197* 5.0	*4.3* 1.3	*2.2* 0.7	*10.8* 3.3	*4.3* 1.3
3 *80*	3.500 *88.9*	0.216 *5.5*	5.1 *1.6*	2.6 *0.8*	12.8 *3.9*	5.1 *1.6*
4¼ O.D. 108.0	*4.250* 108.0	*0.220* 5.6	*6.4* 2.0	*3.2* 1.0	*16.1* 4.9	*6.4* 2.0
4 *100*	4.500 *114.3*	0.237 *6.0*	6.7 *2.0*	3.4 *1.0*	16.8 *5.1*	6.7 *2.0*
5¼ O.D. 133.0	*5.236* 133.0	*0.248* 6.3	*8.0* 2.4	*4.0* 1.2	*20.1* 6.1	*8.0* 2.4
5½ O.D. 139.7	*5.500* 139.7	*0.248* 6.3	*8.3* 2.5	*4.2* 1.3	*20.9* 6.4	*8.3* 2.5
5 *125*	5.563 *141.3*	0.258 *6.6*	8.4 *2.6*	4.2 *1.3*	21.0 *6.4*	8.4 *2.6*
6¼ O.D. 159.0	*6.259* 159.0	*0.280* 7.1	*9.7* 3.0	*4.9* 1.5	*24.3* 7.4	*9.7* 3.0
6½ O.D. 165.1	*6.500* 165.1	*0.280* 7.1	*10.0* 3.0	*5.0* 1.5	*24.9* 7.6	*10.0* 3.0
6 *150*	6.625 *168.3*	0.280 *7.1*	10.1 *3.1*	5.1 *1.6*	25.3 *7.7*	10.1 *3.1*
8 *200*	8.625 *219.1*	0.322 *8.2*	13.3 *4.1*	6.7 *2.0*	33.3 *10.1*	13.3 *4.1*
10 *250*	10.750 *273.1*	0.365 *9.3*	16.7 *5.1*	8.4 *2.6*	41.8 *12.7*	16.7 *5.1*
12 *300*	12.750 *323.9*	0.375 *9.5*	20.0 *6.1*	10.0 *3.0*	50.0 *15.2*	20.0 *6.1*
14 *350*	14.000 *355.6*	0.375 *9.5*	22.2 *6.8*	17.7 *5.4*	64.2 *19.6*	22.9 *7.0*
16 *400*	16.000 *406.4*	0.375 *9.5*	25.5 *7.8*	20.4 *6.2*	73.9 *22.5*	26.4 *8.0*
18 *450*	18.000 *457.2*	0.375 *9.5*	28.9 *8.8*	23.1 *7.0*	87.2 *26.6*	31.1 *9.5*
20 *500*	20.000 *508.0*	0.375 *9.5*	32.2 *9.8*	25.7 *7.8*	97.3 *29.7*	34.8 *10.6*
24 *600*	24.000 *609.6*	0.375 *9.5*	38.9 *11.9*	31.1 *9.5*	113.0 *34.4*	40.4 *12.3*

For the reducing tee and branches, use the value that is corresponding to the branch size. For example: for 6" x 6" x 3" tee, the branch value of 3" is 12.8 ft (3.9).

MATERIAL SPECIFICATIONS

CAST FITTINGS:

Ductile iron conforming to ASTM A 536, Grade 65-45-12
Malleable iron conforming to ASTM A 47

FABRICATED FITTINGS:

1-12" Carbon steel, Schedule 40, conforming to ASTM A 53, Grade B
14-24" Carbon steel, 0.375 wall, conforming to ASTM A 53, Grade B

COATINGS:

Rust inhibiting paint – Color: ORANGE (standard)
Hot Dipped Zinc Galvanized conforming to ASTM A 153 (optional)
Other Colors Available (IE: RAL3000 and RAL9000)

FITTING SIZE

Nominal Size	O.D.	Nominal Size	O.D.
In./DN(mm)	*In./mm*	*In./DN(mm)*	*In./mm*
1 *25*	1.315 *33.4*	5 *140*	5.563 *141.3*
1¼ *32*	1.660 *42.4*	*6¼ O.D.* 159.0	*6.259* 159.0
1½ *40*	1.900 *48.3*	*6½ O.D.* 165.1	*6.500* 165.1
2 *50*	2.375 *60.3*	6 *150*	6.625 *168.3*
2½ *65*	2.875 *73.0*	8 *200*	8.625 *219.1*
3 O.D. 76.1	*2.996* 76.1	10 *250*	10.750 *273.0*
3 *80*	3.500 *88.9*	12 *300*	12.750 *323.9*
3½ *90*	4.000 *101.6*	14 *350*	14.000 *355.6*
4¼ O.D. 108.0	*4.250* 108.0	16 *400*	16.000 *406.4*
4 *100*	4.500 *114.3*	18 *450*	18.000 *457.2*
5¼ O.D. 133.0	*5.236* 133.0	20 *500*	20.000 *508.0*
5½ O.D. 139.7	*5.500* 139.7	24 *600*	24.000 *609.6*

The Fitting Size Chart is used to determine the O.D. of the pipe that the fittings is to be used with. Gruvlok Fittings are identified by either the Nominal size in inches or the Pipe O.D. in/mm.

FIG. 7050

90° Elbow*

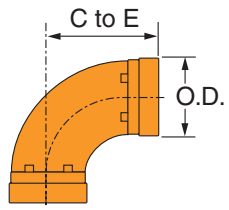


FIGURE 7050
90° ELBOW*

Nominal Size	O.D.	Center to End	Approx. Wt. Ea.
In./DN(mm)	*In./mm*	*In./mm*	*Lbs./Kg*
1 *25*	1.315 *33.4*	2¼ C *57*	0.6 *0.3*
1¼ *32*	1.660 *42.2*	2¾ C *70*	1.0 *0.5*
1½ *40*	1.900 *48.3*	2¾ C *70*	1.2 *0.5*
2 *50*	2.375 *60.3*	3¼ C *83*	1.7 *0.8*
2½ *65*	2.875 *73.0*	3¾ C *95*	2.6 *1.2*
3 O.D. 76.1	*2.996* 76.1	*4 C* 102	*3.6* 1.6
3 *80*	3.500 *88.9*	4¼ C *108*	4.0 *1.8*
3½ *90*	4.000 *101.6*	4½ C *114*	5.5 *2.5*
4¼ O.D. 108.0	*4.250* 108.0	*4¾ C* 121	*7.7* 3.5
4 *100*	4.500 *114.3*	5 C *127*	7.7 *3.5*
5¼ O.D. 133.0	*5.236* 133.0	*5¼ C* 133	*10.4* 4.7
5½ O.D. 139.7	*5.500* 139.7	*5¼ C* 133	*10.9* 4.9
5 *125*	5.563 *141.3*	5½ C *140*	11.1 *5.0*
6¼ O.D. 159.0	*6.259* 159.0	*6 C* 152	*15.2* 6.9
6½ O.D. 165.1	*6.500* 165.1	*6½ C* 165	*17.4* 7.9
6 *150*	6.625 *168.3*	6½ C *165*	16.5 *7.5*
8 *200*	8.625 *219.1*	7¾ C *197*	30.6 *13.9*
10 *250*	10.750 *273.1*	9 C *229*	53.5 *24.3*
12 *300*	12.750 *323.9*	10 C *254*	82 *37.2*
14* *350*	14.000 *355.6*	21 *533*	169.0 *76.7*
16* *400*	16.000 *406.4*	24 *610*	222.0 *100.7*
18* *450*	18.000 *457.2*	27 *686*	280.0 *127.0*
20* *500*	20.000 *508.0*	30 *762*	344.0 *156.0*
24* *600*	24.000 *609.6*	36 *914*	490.0 *222.3*

FIG. 7051

45° Elbow*

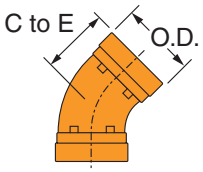


FIGURE 7051
45° ELBOW*

Nominal Size	O.D.	Center to End	Approx. Wt. Ea.
In./DN(mm)	*In./mm*	*In./mm*	*Lbs./Kg*
1 *25*	1.315 *33.4*	1¾ C *44*	0.5 *0.2*
1¼ *32*	1.660 *42.2*	1¾ C *44*	0.7 *0.3*
1½ *40*	1.900 *48.3*	1¾ C *44*	0.9 *0.4*
2 *50*	2.375 *60.3*	2 C *51*	1.5 *0.7*
2½ *65*	2.875 *73.0*	2¼ C *57*	1.9 *0.9*
3 O.D. 76.1	*2.996* 76.1	*2½ C* 64	*2.2* 1.0
3 *80*	3.500 *88.9*	2½ C *64*	3.3 *1.5*
3½ *90*	4.000 *101.6*	2¾ C *70*	4.3 *2.0*
4¼ O.D. 108.0	*4.250* 108.0	*2⅞ C* 83	*4.4* 2.0
4 *100*	4.500 *114.3*	3 C *76*	5.4 *2.4*
5¼ O.D. 133.0	*5.236* 133.0	*3¼ C* 83	*7.3* 3.3
5½ O.D. 139.7	*5.500* 139.7	*3¼ C* 83	*7.8* 3.5
5 *125*	5.563 *141.3*	3¼ C *83*	9.0 *4.1*
6¼ O.D. 159.0	*6.259* 159.0	*3½ C* 89	*10.1* 4.6
6½ O.D. 165.1	*6.500* 165.1	*3½ C* 89	*11.1* 5.0
6 *150*	6.625 *168.3*	3½ C *89*	11.2 *5.1*
8 *200*	8.625 *219.1*	4¼ C *108*	19.8 *9.0*
10 *250*	10.750 *273.1*	4¾ C *121*	34.3 *15.6*
12 *300*	12.750 *323.9*	5¼ C *133*	50.0 *22.7*
14* *350*	14.000 *355.6*	8¾ *222*	92.0 *41.7*
16* *400*	16.000 *406.4*	10 *254*	117.0 *53.1*
18* *450*	18.000 *457.2*	11¼ *286*	146.0 *66.2*
20* *500*	20.000 *508.0*	12½ *317*	179.0 *81.2*
24* *600*	24.000 *609.6*	15 *381*	255.0 *115.7*

FIG. 7052

22 ½° Elbow

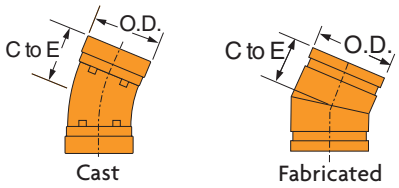


FIGURE 7052
22½° ELBOW*

Nominal Size	O.D.	Center to End	Approx. Wt. Ea.
In./DN(mm)	*In./mm*	*In./mm*	*Lbs./Kg*
1 *25*	1.315 *33.4*	3¼ *83*	0.5 *0.2*
1¼ *32*	1.660 *42.2*	1¾ *44*	0.7 *0.3*
1½ *40*	1.900 *48.3*	1¾ *44*	0.8 *0.4*
2 *50*	2.375 *60.3*	1⅞ C *48*	1.5 *0.7*
2½ *65*	2.875 *73.0*	2 *51*	1.9 *0.9*
3 *80*	3.500 *88.9*	2¼ C *57*	3.2 *1.5*
3½ *90*	4.000 *101.6*	2½ *64*	4.0 *1.8*
4 *100*	4.500 *114.3*	2⅝ C *67*	5.3 *2.4*
5 *125*	5.563 *141.3*	2⅞ *73*	7.2 *3.3*
6 *150*	6.625 *168.3*	3⅛ C *79*	8.2 *3.7*
8 *200*	8.625 *219.1*	3⅞ C *98*	17.8 *8.1*
10 *250*	10.750 *273.1*	4⅜ *111*	30.0 *13.6*
12 *300*	12.750 *323.9*	4⅞ *124*	40.4 *18.3*
14 *350*	14.000 *355.6*	5 *127*	46.0 *20.9*
16 *400*	16.000 *406.4*	5 *127*	52.2 *23.7*
18 *450*	18.000 *457.2*	5½ *140*	65.0 *29.5*
20 *500*	20.000 *508.0*	6 *152*	80.0 *36.3*
24 *600*	24.000 *609.6*	7 *178*	112.0 *50.8*

c UL us LISTED FM APPROVED

For Listings/Approval Details and Limitations, visit our website at www.anvilintl.com or contact an Anvil® Sales Representative.

C - Cast ductile iron, all others are fabricated steel.
* 14"-24" Standard Radius 90° & 45° Elbows are 1½ Long Radius.
Center to end dimensions and weights may differ from those shown in chart, contact an Anvil Representative for more information.

FIG. 7053

11 ¼° Elbow

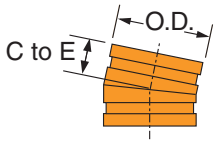


FIGURE 7053
11¼° ELBOW

Nominal Size	O.D.	Center to End	Approx. Wt. Ea.
In./DN(mm)	*In./mm*	*In./mm*	*Lbs./Kg*
1 *25*	1.315 *33.4*	1⅜ *35*	0.3 *0.1*
1¼ *32*	1.660 *42.2*	1⅜ *35*	0.5 *0.2*
1½ *40*	1.900 *48.3*	1⅜ *35*	0.7 *0.3*
2 *50*	2.375 *60.3*	1⅜ *35*	0.9 *0.4*
2½ *65*	2.875 *73.0*	1½ *38*	1.5 *0.7*
3 *80*	3.500 *88.9*	1½ *38*	2.0 *0.9*
3½ *90*	4.000 *101.6*	1¾ *44*	2.8 *1.3*
4 *100*	4.500 *114.3*	1¾ *44*	3.3 *1.5*
5 *125*	5.563 *141.3*	2 *51*	5.0 *2.3*
6 *150*	6.625 *168.3*	2 *51*	6.5 *2.9*
8 *200*	8.625 *219.1*	2 *51*	10.0 *4.5*
10 *250*	10.750 *273.1*	2⅛ *54*	14.5 *6.6*
12 *300*	12.750 *323.9*	2¼ *57*	18.7 *8.5*
14 *350*	14.000 *355.6*	3½ *89*	32.1 *14.6*
16 *400*	16.000 *406.4*	4 *102*	42.0 *19.1*
18 *450*	18.000 *457.2*	4½ *114*	53.2 *24.1*
20 *500*	20.000 *508.0*	5 *127*	65.7 *29.8*
24 *600*	24.000 *609.6*	6 *152*	96.0 *43.5*

FIG. 7050LR

90° Long Radius Elbow

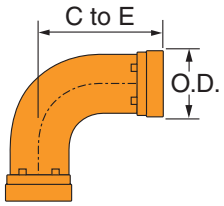


FIGURE 7050 LR
LONG RADIUS 90° ELBOW

Nominal Size	O.D.	Center to End	Approx. Wt. Ea.
In./DN(mm)	*In./mm*	*In./mm*	*Lbs./Kg*
1 *25*	1.315 *33.4*	3½ *89*	0.9 *0.4*
1¼ *32*	1.660 *42.2*	3⅞ *98*	1.3 *0.6*
1½ *40*	1.900 *48.3*	4¼ *108*	1.7 *0.8*
2 *50*	2.375 *60.3*	4⅜ *136*	2.5 *1.1*
2½ *65*	2.875 *73.0*	5¾ *146*	4.9 *2.2*
3 *80*	3.500 *88.9*	5⅞ *181*	6.5 *2.9*
3½ *90*	4.000 *101.6*	7¼ *184*	9.7 *4.4*
4 *100*	4.500 *114.3*	7½ *191*	11.5 *5.2*
5 *125*	5.563 *141.3*	9½ *241*	20.9 *9.5*
6 *150*	6.625 *168.3*	10¾ *273*	29.1 *13.2*
8 *200*	8.625 *219.1*	15 *381*	59.2 *26.9*
10 *250*	10.750 *273.1*	18 *457*	104.0 *47.2*
12 *300*	12.750 *323.9*	21 *533*	147.0 *66.7*
14 *350*	14.000 *355.6*	21 *533*	169.0 *76.7*
16 *400*	16.000 *406.4*	24 *610*	222.0 *100.7*
18 *450*	18.000 *457.2*	27 *686*	280.0 *127.0*
20 *500*	20.000 *508.0*	30 *762*	344.0 *156.0*
24 *600*	24.000 *609.6*	36 *914*	490.0 *222.3*

FIG. 7051LR

45° Long Radius Elbow

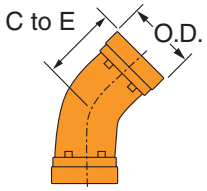


FIGURE 7051 LR
LONG RADIUS 45° ELBOW

Nominal Size	O.D.	Center to End	Approx. Wt. Ea.
In./DN(mm)	*In./mm*	*In./mm*	*Lbs./Kg*
1 *25*	1.315 *33.4*	2½ *64*	0.7 *0.3*
1¼ *32*	1.660 *42.2*	2½ *64*	1.0 *0.5*
1½ *40*	1.900 *48.3*	2½ *64*	1.2 *0.5*
2 *50*	2.375 *60.3*	2¾ *70*	1.7 *0.8*
2½ *65*	2.875 *73.0*	3 *76*	2.9 *1.3*
3 *80*	3.500 *88.9*	3⅜ *86*	4.3 *2.0*
3½ *90*	4.000 *101.6*	3½ *89*	5.3 *2.4*
4 *100*	4.500 *114.3*	4 *102*	7.2 *3.3*
5 *125*	5.563 *141.3*	5 *127*	12.2 *5.5*
6 *150*	6.625 *168.3*	5½ *140*	17.4 *7.9*
8 *200*	8.625 *219.1*	7¼ *184*	34.0 *15.4*
10 *250*	10.750 *273.1*	8½ *216*	57.4 *26.0*
12 *300*	12.750 *323.9*	10 *254*	82.6 *37.5*
14 *350*	14.000 *355.6*	8¾ *222*	92.0 *41.7*
16 *400*	16.000 *406.4*	10 *254*	117.0 *53.1*
18 *450*	18.000 *457.2*	11¼ *286*	146.0 *66.2*
20 *500*	20.000 *508.0*	12½ *317*	179.0 *81.2*
24 *600*	24.000 *609.6*	15 *381*	255.0 *115.7*

C - Cast ductile iron, all others are fabricated steel.
Center to end dimensions and weights may differ from those shown in chart, Contact an Anvil Representative for more information.

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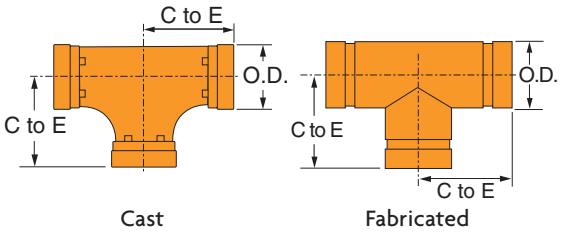
FIG. 7060

Tee



Cast Fabricated

FIGURE 7060 TEE

Nominal Size	O.D.	Center to End	Approx. Wt. Ea.
In./DN(mm)	*In./mm*	*In./mm*	*Lbs./Kg*
1 *25*	1.315 *33.4*	2¼ C *57*	0.9 *0.4*
1¼ *32*	1.660 *42.2*	2¾ C *70*	1.5 *0.7*
1½ *40*	1.900 *48.3*	2¾ C *70*	1.8 *0.8*
2 *50*	2.375 *60.3*	3¼ C *83*	2.4 *1.1*
2½ *65*	2.875 *73.0*	3¾ C *95*	4.0 *1.8*
3 O.D. 76.1	*2.996* 76.1	*4 C* 101	*4.6* 2.1
3 *80*	3.500 *88.9*	4¼ C *108*	5.8 *2.6*
3½ *90*	4.000 *101.6*	4½ C *114*	9.8 *4.4*
4¼ O.D. 108.0	*4.250* 108.0	*4¾ C* 121	*9.3* 4.2
4 *100*	4.500 *114.3*	5 C *127*	10.3 *4.7*
5¼ O.D. 133.0	*5.236* 133.0	*5¼ C* 133	*14.1* 6.4
5½ O.D. 139.7	*5.500* 139.7	*5½ C* 140	*16.1* 7.3
5 *125*	5.563 *141.3*	5½ C *140*	16.2 *7.3*
6¼ O.D. 159.0	*6.259* 159.0	*6 C* 152	*20.8* 9.4
6½ O.D. 165.1	*6.500* 165.1	*6½ C* 165	*24.4* 11.1
6 *150*	6.625 *168.3*	6½ C *165*	25.7 *11.7*
8 *200*	8.625 *219.1*	7¾ C *197*	41.1 *18.6*
10 *250*	10.750 *273.1*	9 C *229*	74.5 *33.8*
12 *300*	12.750 *323.9*	10 C *254*	94.7 *43.0*
14 *350*	14.000 *355.6*	11 *279*	118.0 *53.5*
16 *400*	16.000 *406.4*	12 *305*	146.0 *66.2*
18 *450*	18.000 *457.2*	15½ *394*	218.0 *98.9*
20 *500*	20.000 *508.0*	17¼ *438*	275.0 *125*
24 *600*	24.000 *609.6*	20 *508*	379.0 *172*

C - Cast ductile iron, all others are fabricated steel.

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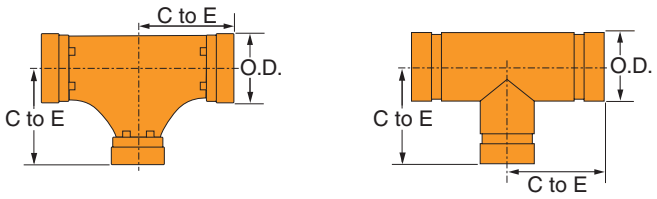
FIG. 7061

Reducing Tee Standard



Cast Fabricated

FIGURE 7061 STANDARD REDUCING TEE

Nominal Size	Center to End	Approx. Wt. Ea.	Nominal Size	Center to End	Approx. Wt. Ea.	Nominal Size	Center to End	Approx. Wt. Ea.
In./DN(mm)	*In./mm*	*Lbs./Kg*	*In./DN(mm)*	*In./mm*	*Lbs./Kg*	*In./DN(mm)*	*In./mm*	*Lbs./Kg*
1¼ x 1¼ x 1 *32 x 32 x 25*	2¾ *70*	1.5 *0.7*	5 x 5 x 2 *125 x 125 x 50*	5½ *140*	14 *6.4*	10 x 10 x 8 *250 x 250 x 200*	9 *229*	64.7 *29.3*
1½ x 1½ x 1 *40 x 40 x 25*	2¾ *70*	1.8 *0.8*	5 x 5 x 2½ *125 x 125 x 65*	5½ *140*	14.3 *6.5*	12 x 12 x 4 *300 x 300 x 100*	10 *254*	75.1 *34.1*
1½ x 1½ x 1¼ *40 x 40 x 32*	2¾ *70*	1.8 *0.8*	5 x 5 x 3 *125 x 125 x 80*	5½ *140*	14.6 *6.6*	12 x 12 x 5 *300 x 300 x 125*	10 *254*	75.6 *34.3*
2 x 2 x 1 *50 x 50 x 25*	3¼ C *83*	2.6 *1.2*	5 x 5 x 4 *125 x 125 x 100*	5½ C *140*	17.9 *8.1*	12 x 12 x 6 *300 x 300 x 150*	10 *254*	76.2 *34.6*
2 x 2 x 1¼ *50 x 50 x 32*	3¼ *83*	1.7 *0.8*	6 x 6 x 1 *150 x 150 x 25*	6½ *165*	20.5 *9.3*	12 x 12 x 8 *300 x 300 x 200*	10 *254*	76.3 *34.6*
2 x 2 x 1½ *50 x 50 x 40*	3¼ C *83*	2.7 *1.2*	6 x 6 x 1¼ *150 x 150 x 32*	6½ *165*	20.7 *9.4*	12 x 12 x 10 *300 x 300 x 250*	10 *254*	77.6 *35.2*
2½ x 2½ x 1 *65 x 65 x 25*	3¾ *95*	4.1 *1.9*	6 x 6 x 1½ *150 x 150 x 40*	6½ *165*	21.0 *9.5*	14 x 14 x 6 *350 x 350 x 150*	11 *279*	101 *45.8*
2½ x 2½ x 1¼ *65 x 65 x 32*	3¾ *95*	4.2 *1.9*	6 x 6 x 2 *150 x 150 x 50*	6½ C *165*	26.4 *12.0*	14 x 14 x 8 *350 x 350 x 200*	11 *279*	103 *46.7*
2½ x 2½ x 1½ *65 x 65 x 40*	3¾ *95*	4.3 *2.0*	6 x 6 x 2½ *150 x 150 x 65*	6½ C *165*	26.5 *12.0*	14 x 14 x 10 *350 x 350 x 250*	11 *279*	104 *47.2*
2½ x 2½ x 2 *65 x 65 x 50*	3¾ *95*	4.4 *2.0*	6 x 6 x 3 *150 x 150 x 80*	6½ C *165*	26.5 *12.0*	14 x 14 x 12 *350 x 350 x 300*	11 *279*	105 *47.6*
3 x 3 x 1 *80 x 80 x 25*	4¼ C *108*	7.0 *3.2*	6 x 6 x 4 *150 x 150 x 100*	6½ C *165*	26.5 *12.0*	16 x 16 x 10 *400 x 400 x 250*	12 *305*	129 *58.5*
3 x 3 x 1¼ *80 x 80 x 32*	4¼ *108*	5.8 *2.6*	6 x 6 x 5 *150 x 150 x 125*	6½ C *165*	28.0 *12.7*	16 x 16 x 12 *400 x 400 x 300*	12 *305*	130 *59.0*
3 x 3 x 1½ *80 x 80 x 40*	4¼ *108*	5.9 *2.7*	8 x 8 x 2 *200 x 200 x 50*	7¾ *197*	32.7 *14.8*	16 x 16 x 14 *400 x 400 x 350*	12 *305*	132 *59.9*
3 x 3 x 2 *80 x 80 x 50*	4¼ C *108*	5.5 *2.5*	8 x 8 x 2½ *200 x 200 x 65*	7¾ *197*	33.0 *15.0*	18 x 18 x 10 *450 x 450 x 250*	15½ *394*	194 *88.0*
3 x 3 x 2½ *80 x 80 x 65*	4¼ *108*	6.3 *2.9*	8 x 8 x 3 *200 x 200 x 80*	7¾ *197*	33.5 *15.2*	18 x 18 x 12 *450 x 450 x 300*	15½ *394*	196 *88.9*
4 x 4 x 1 *100 x 100 x 25*	3¾ *95*	7.0 *3.2*	8 x 8 x 4 *200 x 200 x 100*	7¾ C *197*	50.0 *22.7*	18 x 18 x 14 *450 x 450 x 350*	15½ *394*	201 *91.2*
4 x 4 x 1¼ *100 x 100 x 32*	5 *127*	9.6 *4.4*	8 x 8 x 5 *200 x 200 x 125*	7¾ *197*	34.7 *15.7*	18 x 18 x 16 *450 x 450 x 400*	15½ *394*	203 *92.1*
4 x 4 x 1½ *100 x 100 x 40*	5 *127*	10.2 *4.6*	8 x 8 x 6 *200 x 200 x 150*	7¾C *197*	54.0 *24.5*	20 x 20 x 12 *500 x 500 x 300*	17¼ *438*	246 *111.6*
4 x 4 x 2 *100 x 100 x 50*	5 C *127*	10.2 *4.6*	10 x 10 x 2 *250 x 250 x 50*	9 *229*	52.2 *23.7*	20 x 20 x 14 *500 x 500 x 350*	17¼ *438*	248 *112.5*
4 x 4 x 2½ *100 x 100 x 65*	5 C *127*	11.2 *5.1*	10 x 10 x 2½ *250 x 250 x 65*	9 *229*	52.6 *23.9*	20 x 20 x 16 *500 x 500 x 400*	17¼ *438*	250 *113.4*
4 x 4 x 3 *100 x 100 x 80*	5 C *127*	11.4 *5.2*	10 x 10 x 3 *250 x 250 x 80*	9 *229*	53.0 *24.0*	20 x 20 x 18 *500 x 500 x 450*	17¼ *438*	252 *114.3*
5 x 5 x 1 *125 x 125 x 25*	5½ *140*	13.6 *6.2*	10 x 10 x 4 *250 x 250 x 100*	9 *229*	53.6 *24.3*	24 x 24 x 16 *600 x 600 x 400*	20 *508*	342 *155.1*
5 x 5 x 1¼ *125 x 125 x 32*	5½ *140*	13.7 *6.2*	10 x 10 x 5 *250 x 250 x 125*	9 *229*	54.2 *24.6*	24 x 24 x 18 *600 x 600 x 450*	20 *508*	345 *156.5*
5 x 5 x 1½ *125 x 125 x 40*	5½ *140*	13.8 *6.3*	10 x 10 x 6 *250 x 250 x 150*	9 *229*	55.0 *24.9*	24 x 24 x 20 *600 x 600 x 500*	20 *508*	347 *157.4*

Center to end dimensions and weights may differ from those shown in chart, contact an Anvil Representative for more information.

See Fitting Size chart on page 61 for O.D.

FIG. 7074

Cap

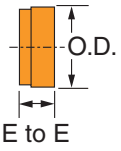


Fig. 7074T: 1/2", 3/4" and 1" tap options available.

FIGURE 7074 CAP			
Nominal Size	O.D.	End to End	Approx. Wt. Ea.
In./DN(mm)	*In./mm*	*In./mm*	*Lbs./Kg*
1C *25*	1.315 *33.4*	1¼ *32*	0.3 *0.1*
1¼ C *32*	1.660 *42.2*	1¼ *32*	0.4 *0.2*
1½ C *40*	1.900 *48.3*	1¼ *32*	0.5 *0.2*
2 C *50*	2.375 *60.3*	1 *25*	0.5 *0.2*
2½ C *65*	2.875 *73.0*	1 *25*	0.7 *0.3*
3 O.D. C 76.1	*2.996* 76.1	*1* 25	*0.8* 0.4
3 C *80*	3.500 *88.9*	1 *25*	1.1 *0.5*
3½ C *90*	4.000 *101.6*	1 *25*	1.4 *0.6*
4¼ O.D. C 108.0	*4.250* 108.0	*1⅛* 29	*2.0* 0.9
4 C *100*	4.500 *114.3*	1⅛ *29*	2.8 *1.3*
5¼ O.D. C 133.0	*5.236* 133.0	*1⅛* 29	*3.2* 1.5
5½ O.D. C 139.7	*5.500* 139.7	*1⅛* 29	*4.0* 1.8
5 C *125*	5.563 *141.3*	1⅛ *29*	4.0 *1.8*
6¼ O.D. C 159.0	*6.259* 159.0	*1⅛* 29	*5.1* 2.3
6½ O.D. C 165.1	*6.500* 165.1	*1⅛* 29	*6.0* 2.7
6 C *150*	6.625 *168.3*	1 5/16 *33*	6.0 *2.7*
8 C *200*	8.625 *219.1*	1½ *38*	12.5 *5.7*
10 C *250*	10.750 *273.1*	1½ *38*	21.9 *9.9*
12 C *300*	12.750 *323.9*	1½ *38*	33.8 *15.3*
14* *350*	14.000 *355.6*	8½ *216*	40 *18.1*
16* *400*	16.000 *406.4*	9 *229*	45 *20.4*
18* *450*	18.000 *457.2*	10 *254*	58 *26.3*
20* *500*	20.000 *508.0*	11 *279*	79 *35.8*
24* *600*	24.000 *609.6*	12½ *318*	100 *45.4*

* Machined Dome Cap
C - Cast Ductile Iron

FIG. 7075

Bull Plug

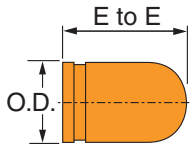


FIGURE 7075 BULL PLUG			
Nominal Size	O.D.	End to End	Approx. Wt. Ea.
In./DN(mm)	*In./mm*	*In./mm*	*Lbs./Kg*
2 *50*	2.375 *60.3*	4 *102*	2.5 *1.1*
2½ *65*	2.875 *73.0*	5 *127*	3.1 *1.4*
3 *80*	3.500 *88.9*	6 *152*	4.4 *2.0*
4 *100*	4.500 *114.3*	7 *178*	7.4 *3.4*
5 *125*	5.563 *141.3*	9 *22*	13.0 *
6 *150*	6.625 *168.3*	10 *254*	18.5 *8.4*

This product is not UL/ULC Listed or FM Approved.

FIG. 7068

Cross

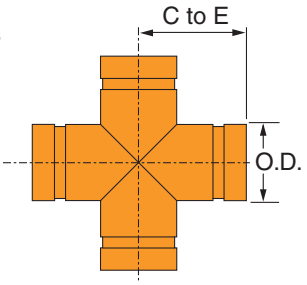


FIGURE 7068 CROSS			
Nominal Size	O.D.	Center to End	Approx. Wt. Ea.
In./DN(mm)	*In./mm*	*In./mm*	*Lbs./Kg*
1 *25*	1.315 *33.4*	2¼ *57*	1.3 *0.6*
1¼ *32*	1.660 *42.2*	2¾ *70*	2.1 *1.0*
1½ *40*	1.900 *48.3*	2¾ *70*	2.5 *1.1*
2 *50*	2.375 *60.3*	3¼ *83*	2.9 *1.3*
2½ *65*	2.875 *73.0*	3¾ *95*	5.2 *2.4*
3 *80*	3.500 *88.9*	4¼ *108*	7.5 *3.4*
3½ *90*	4.000 *101.6*	4½ *114*	9.8 *4.4*
4 *100*	4.500 *114.3*	5 *127*	12.2 *5.5*
5 *125*	5.563 *141.3*	5½ *140*	17.6 *8.0*
6 *150*	6.625 *168.3*	6½ *165*	28.3 *12.8*
8 *200*	8.625 *219.1*	7¾ *197*	48.0 *21.8*
10 *250*	10.750 *273.1*	9 *229*	70.0 *31.8*
12 *300*	12.750 *323.9*	10 *254*	110 *49.9*
14 *350*	14.000 *355.6*	11 *279*	140 *63.5*
16 *400*	16.000 *406.4*	12 *305*	170 *77.1*
18 *450*	18.000 *457.2*	15½ *394*	260 *118*
20 *500*	20.000 *508.0*	17¼ *438*	320 *145*
24 *600*	24.000 *609.6*	20 *508*	585 *265*

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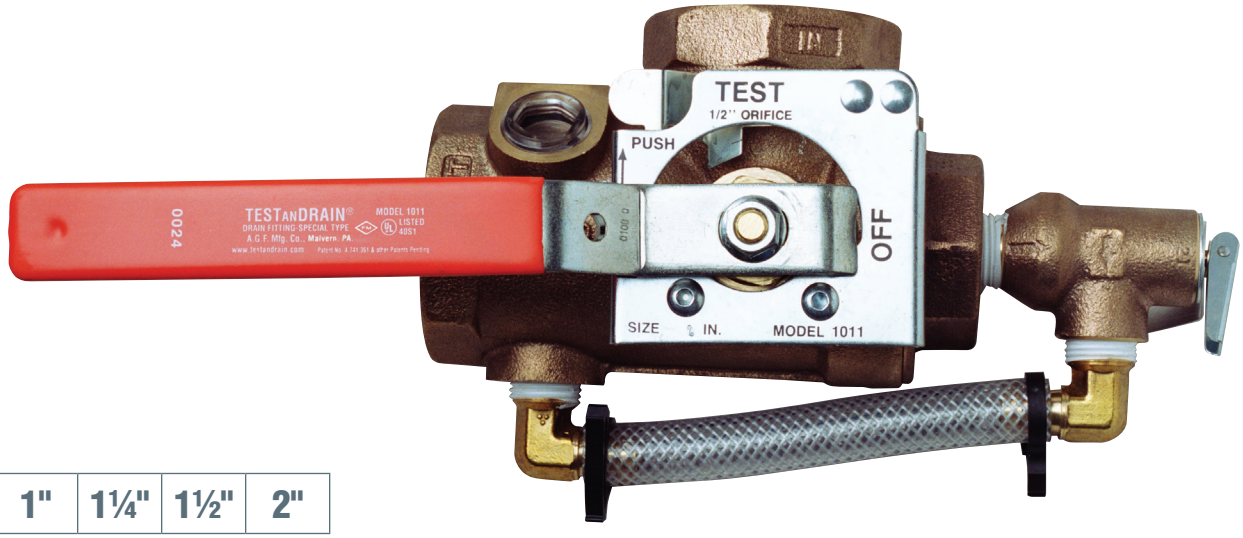
Model 1011A
TESTANDRAIN®

Sectional Floor Control Test and Drain Valve for Systems Requiring Pressure Relief Valve



Sizes:

¾"	1"	1¼"	1½"	2"

The AGF **Model 1011A TESTANDRAIN®** provides the test and express drain functions for wet fire sprinkler systems on multi-story installations requiring pressure relief (NFPA 13 and NFPA 13R). The **Model 1011A** features a **Model 7000 Pressure Relief Valve** with drain pipe.

The **Model 1011A** is available in a full range of sizes (¾" to 2") with NPT connections (BSPT available). The **Model 7000 Pressure Relief Valve** (UL/FM) features a flushing handle and a 175 PSI factory rating (other pressure ratings available).

- Complies with NFPA 13 and NFPA 13R Requirements
- Compact, Single-Handle Ball Valve
- Tamper-Resistant Test Orifice and Sight Glasses
- 300 PSI rated.
- Specifiable orifice sizes: ⅜" (2.8K), 7⁄16" (4.2K), ½" (5.6K), 17⁄32" (8.0K), ⅝" (11.2K, ELO), ¾" (14.0K, ESFR), and K25
- Relieves Excess System Pressure caused by Surges or Temperature Changes
- Shipped with Relief Valve and Bypass Drain Ports Plugged to Expedite Pressure Testing
- Locking Kit Available

Repair kits are available for all **TESTANDRAIN®** valves. Kit includes: Adapter Gasket (1), Ball (1), Valve Seats (2), Stem Packing (1), and Stem Washer (1). ***Valve and orifice size must be specified when ordering.***

NOTE: It is important to note that the pressure rating of the relief valve indicates an operating range of pressure for both opening and closing of the valve. Standard relief valves are required to OPEN in a range of pressure between 90% and 105% of their rating. The valves are required to CLOSE at a pressure above 80% of that rating. The relief valve should be installed where it is easily accessible for maintenance. Care should be taken that the relief valve CANNOT be isolated from the system when the system is operational. A relief valve should NEVER have a shutoff valve or a plug downstream of its outlet.

Reliability, Versatility, Code Compatibility

Model 1011A
TEST AN DRAIN®

Model 1011A 300 PSI Bronze Ball Valve, Model 7000 Pressure Relief Valve
Factory Rated at 175 PSI with other setting available

Dimensions

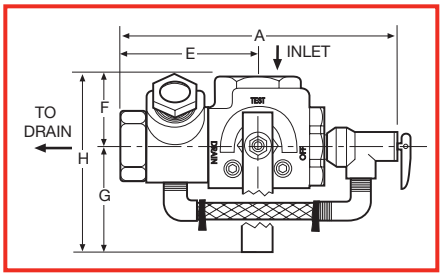
SIZE	A	B	C	D	E	F	G	H
¾"	7 9/16" (191 mm)	1 1/2" (37.5 mm)	2 3/16" (57 mm)	3 5/8" (93 mm)	3 3/8" (86 mm)	1 13/16" (46 mm)	4 9/16" (117 mm)	6 3/8" (162.5 mm)
1"	7 9/16" (191 mm)	1 1/2" (37.5 mm)	2 3/16" (57 mm)	3 5/8" (93 mm)	3 3/8" (86 mm)	1 13/16" (46 mm)	4 9/16" (117 mm)	6 3/8" (162.5 mm)
1¼"	7 15/16" (201 mm)	1 11/16" (43 mm)	2 9/16" (65 mm)	4 1/4" (108 mm)	3 5/8" (91 mm)	1 15/16" (51 mm)	5 9/16" (141 mm)	7 1/2" (192 mm)
1½"	8 15/16" (227 mm)	1 13/16" (45 mm)	3 1/4" (81.5 mm)	5 1/16" (127 mm)	3 7/8" (99 mm)	2 5/8" (67 mm)	8 1/4" (207 mm)	10 7/8" (274 mm)
2"	8 15/16" (227 mm)	1 13/16" (45 mm)	3 1/4" (81.5 mm)	5 1/16" (127 mm)	3 7/8" (99 mm)	2 5/8" (67 mm)	8 1/4" (207 mm)	10 7/8" (274 mm)

The Model 1011A provides the following…

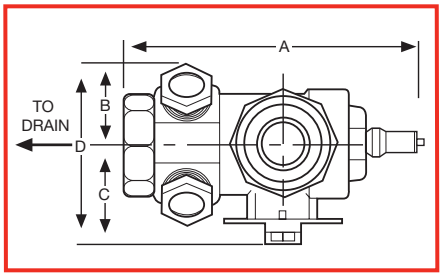
From the 2013 Edition of NFPA 13

Chapter 8.16.2.4.1*	Provisions shall be made to properly drain all parts of the system.
Chapter 8.16.2.4.2 & 8.16.2.4.3	Drain connections, interior sectional or floor control valve(s) – shall be provided with a drain connection having a minimum size as shown in Table 8.16.2.4.2.
Chapter 8.16.2.4.4	Drains shall discharge outside or to a drain capable of handling the flow of the drain.
Chapter A.8.17.4.2	(Wet Pipe System) test connection is permitted to terminate into a drain capable of accepting full flow… using an approved sight test connection containing a smooth bore corrosion-resistant orifice giving a flow equivalent to one sprinkler…
Chapter 8.17.4.2.2	The test connection valve shall be accessible.
Chapter 8.17.4.2.4	shall be permitted to be installed in any location… downstream of the waterflow alarm.
Chapter 8.17.4.3.1	(Dry Pipe System) a trip test connection not less than 1" in diameter, terminating in a smooth bore corrosion-resistant orifice, to provide a flow equivalent to one sprinkler…
Chapter 8.17.4.3.2	The trip test connection… with a shutoff valve and plug not less than 1", at least one of which shall be brass.
Chapter 7.1.2	- a wet pipe system shall be provided with a listed relief valve set to operate at 175 PSI or 10 PSI in excess of the maximum system pressure, whichever is greater.
Chapter 8.16.1.2.3*	A listed relief valve of not less than ½" in size shall be provided on the discharge side of the pressure-reducing valve set to operate at a pressure not exceeding rated pressure of the system.
Chapter A.8.16.1.2.3	- consideration should be given to piping the discharge from the (pressure relief) valve

Model 1011A - Front View



Model 1011A - Plan View



Orifice Sizes

3/8", 7/16", 1/2", 17/32", 5/8" ELO*,
¾" ESFR*, and K25**

Materials

Handle ..... Steel
Stem ..... Rod Brass
Ball..... C.P. Brass
Body ..... Bronze
Valve Seat..... Impregnated Teflon®
Indicator Plate .... Steel
Relief Valve ..... Bronze
Bypass Fittings... Brass
Bypass Tubing.... Nylobraid

Approvals

UL and ULC Listed:
(EX4019 & EX4533)
FM Approved
NYC-BSA No. 720-87-SM

MADE IN U.S.A.

USA Patent # 4741361 and Other Patents Pending

AGF Manufacturing Inc.
100 Quaker Lane, Malvern, PA 19355
Phone: 610-240-4900
Fax: 610-240-4906
www.testandrain.com

Job Name:_____
Architect:_____
Engineer:_____
Contractor:_____

*Available on 1¼" to 2" size units only • **Available on 1½" and 2" size units only

MICROFAST® QUICK RESPONSE UPRIGHT SPRINKLER VK300 (K5.6)

TECHNICAL DATA

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
Visit the Viking website for the latest edition of this technical data page: www.vikinggroupinc.com

1. DESCRIPTION

The Viking Microfast® Quick Response Upright Sprinkler VK300 is a small, thermosensitive, glass-bulb spray sprinkler available in several different finishes and temperature ratings to meet design requirements. The special Polyester and Electroless Nickel PTFE (ENT) coatings can be used in decorative applications where colors are desired. In addition, these coatings have been investigated for installation in corrosive atmospheres and are listed/approved as corrosion resistant as indicated in the Approval Charts. (Note: **FM global approves the ENT coating as corrosion resistant.** FM Global has no approval classification Polyester coatings as corrosion resistant.)

2. LISTINGS AND APPROVALS

cULus Listed: Category VNIV
FM Approved: Classes 2002 and 2020

Refer to Approval Charts and Design Criteria for listing and approval requirements that must be followed.

3. TECHNICAL DATA

Specifications:

Minimum Operating Pressure: 7 psi (0.5 bar)*
Maximum Working Pressure: 175 psi (12 bar) wwp.
Factory tested hydrostatically to 500 psi (34.5 bar)
Testing: U.S.A. Patent No. 4,831,870
Thread size: 1/2” NPT, 15 mm BSP
Nominal K-Factor: 5.6 U.S. (80.6 metric**)
Glass-bulb fluid temperature rated to -65 °F (-55 °C)
Overall Length: 2-3/16” (56 mm)

*cULus Listing, FM Approval, and NFPA 13 installs require a minimum of 7 psi (0.5 bar). The minimum operating pressure for LPCB and CE Approvals ONLY is 5 psi (0.35 bar).

Material Standards:

Frame Casting: Brass UNS-C84400 or QM Brass
Deflector: Brass UNS-C23000 or Copper UNS-C19500
Bulb: Glass, nominal 3 mm diameter
Belleville Spring Sealing Assembly: Nickel Alloy, coated on both sides with PTFE Tape
Screw: Brass UNS-C36000
Pip Cap and Insert Assembly: Copper UNS-C11000 and Stainless Steel UNS-S30400
For Polyester Coated Sprinklers: Belleville Spring-Exposed
For ENT Coated Sprinklers: Belleville Spring-Exposed, Screw and Pipcap - ENT plated

Ordering Information: (Also refer to the current Viking price list.)

Order Viking Microfast® Quick Response Upright Sprinkler VK300 by first adding the appropriate suffix for the sprinkler finish and then the appropriate suffix for the temperature rating to the sprinkler base part number.
Finish Suffix: Brass = A, Chrome = F, White Polyester = M-/W, Black Polyester = M-/B, and ENT = JN
Temperature Suffix (°F/°C): 135°/57° = A, 155°/68° = B, 175°/79° = D, 200°/93° = E, and 286°/141° = G
For example, sprinkler VK300 with a 1/2” NPT thread, Brass finish and a 155 °F/68 °C temperature rating = Part No. 12978AB

Available Finishes And Temperature Ratings: Refer to Table 1.

Accessories: (Also refer to the Viking website.)

Sprinkler Wrench: Standard Wrench: Part No. 21475M/B (available since 2017)

Sprinkler Cabinets:
A. Six-head capacity: Part No. 01724A (available since 1971)
B. Twelve-head capacity: Part No. 01725A (available since 1971)

4. INSTALLATION

Refer to appropriate NFPA Installation Standards.

VIKING®

TECHNICAL DATA

MICROFAST® QUICK RESPONSE UPRIGHT SPRINKLER VK300 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
Visit the Viking website for the latest edition of this technical data page: www.vikinggroupinc.com

5. OPERATION

During fire conditions, the heat-sensitive liquid in the glass bulb expands, causing the glass to shatter, releasing the pip cap and sealing spring assembly. Water flowing through the sprinkler orifice strikes the sprinkler deflector, forming a uniform spray pattern to extinguish or control the fire.

6. INSPECTIONS, TESTS AND MAINTENANCE

Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

7. AVAILABILITY

The Viking Microfast® Quick Response Upright Sprinkler VK300 is available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

TABLE 1: AVAILABLE SPRINKLER TEMPERATURE RATINGS AND FINISHES

Sprinkler Temperature Classification	Sprinkler Nominal Temperature Rating[1]	Maximum Ambient Ceiling Temperature[2]	Bulb Color
Ordinary	135 °F (57 °C)	100 °F (38 °C)	Orange
Ordinary	155 °F (68 °C)	100 °F (38 °C)	Red
Intermediate	175 °F (79 °C)	150 °F (65 °C)	Yellow
Intermediate	200 °F (93 °C)	150 °F (65 °C)	Green
High	286 °F (141 °C)	225 °F (107 °C)	Blue

Sprinkler Finishes: Brass, Chrome, White Polyester, Black Polyester, and ENT

Corrosion-Resistant Coatings[3]: White Polyester, Black Polyester, and Black PTFE. ENT in all temperature ratings except 135 °F (57 °C)

Footnotes

[1] The sprinkler temperature rating is stamped on the deflector.
[2] Based on NFPA-13. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.
[3] The corrosion-resistant coatings have passed the standard corrosion test required by the approving agencies indicated in the Approval Charts. These tests cannot and do not represent all possible corrosive environments. Prior to installation, verify through the end-user that the coatings are compatible with or suitable for the proposed environment. For automatic sprinklers, the coatings indicated are applied to the exposed exterior surfaces only. Note that the spring is exposed on sprinklers with Polyester, ENT, and PTFE coatings. For ENT coated automatic sprinklers, the waterway is coated.

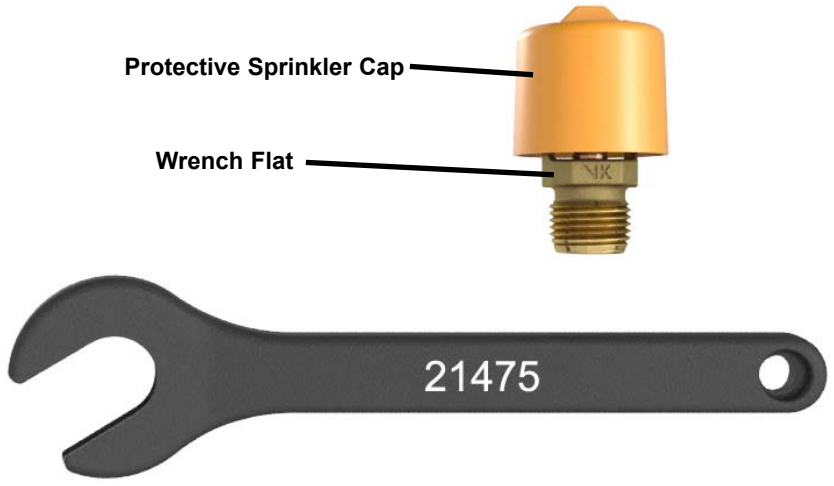


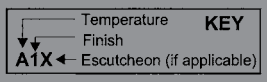
Figure 1:
Standard Sprinkler Wrench 21475M/B

VIKING®	TECHNICAL DATA	MICROFAST® QUICK RESPONSE UPRIGHT SPRINKLER VK300 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
Visit the Viking website for the latest edition of this technical data page: www.vikinggroupinc.com

Approval Chart 1 (UL)

Microfast® Quick Response
Upright Sprinkler VK300
Maximum 175 PSI (12 bar) WWP



Base Part Number[1]	SIN	Thread Size		Nominal K-Factor		Overall Length		Listings and Approvals[3]				
		NPT	BSP	U.S.	metric[2]	Inches	mm	cULus	VdS	LPCB	NYC[8]	CE
12978	VK300	1/2”	15 mm	5.6	80.6	2-3/16	56	A1, B2	--	--	See footnote 7.	--
NOTICE - Product Below - Limited Availability (Contact Local Viking Office)												
06661B	VK300	1/2”	15 mm	5.6	80.6	2-3/16	56	A1, B2	--	--	See footnote 7.	--

Approved Temperature Ratings

A - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141°C)
B - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141°C)

Approved Finishes

1 - Brass, Chrome, White Polyester[5,6], and Black Polyester[5,6]
2 - ENT[6]

Footnotes

[1] Base part number is shown. For complete part number, refer to Viking’s current price schedule.
[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.
[3] This table shows the listings and approvals available at the time of printing. Check with the manufacturer for any additional approvals.
[4] Listed by Underwriters Laboratories Inc. for us in the U.S. and Canada
[5] Other colors are available on request with the same Listings and Approvals as the standard colors.
[6] cULus Listed as corrosion resistant.
[7] Meets New York City requirements, effective July 1, 2008
[8] Accepted for use, City of New York Board of Standards and Appeals, Calendar Number 219-76-SA and City of New York Department of Buildings, MEA 89-92-E, Vol. 16.

DESIGN CRITERIA - UL

(Also refer to Approval Chart 1 above.)

cULus Listing Requirements:

The Viking Microfast® Quick Response Upright Sprinkler VK300 is cULus Listed as indicated in Approval Chart 1 for installation in accordance with the latest edition of NFPA 13 for standard spray sprinklers.

- Designed for use in Light and Ordinary Hazard occupancies.
- The sprinkler installation rules contained in NFPA 13 for standard spray upright sprinklers must be followed.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to Form No. F_080614 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

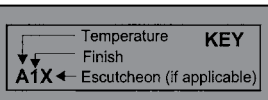
TECHNICAL DATA

MICROFAST® QUICK RESPONSE UPRIGHT SPRINKLER VK300 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
Visit the Viking website for the latest edition of this technical data page: www.vikinggroupinc.com

Approval Chart 2 (FM)

Microfast® Quick Response Upright Sprinkler VK300
Maximum 175 PSI (12 bar) WWP



Base Part Number[1]	SIN	Thread Size		Nominal K-Factor		Overall Length		FM Approvals[3] (Refer also to Design Criteria below.)
		NPT	BSP	U.S.	metric[2]	Inches	mm	
12978	VK300	1/2”	15 mm	5.6	80.6	2-3/16	56	A1, B2
NOTICE - Product Below - Limited Availability (Contact Local Viking Office)								
06661B	VK300	1/2”	15 mm	5.6	80.6	2-3/16	56	A1, B2

Approved Temperature Ratings

A - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141°C)
B - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141°C)

Approved Finishes

1 - Brass, Chrome, White Polyester[5], and Black Polyester[5]
2 - ENT[6]

Footnotes

[1] Base part number is shown. For complete part number, refer to Viking’s current price schedule.

[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

[3] This table shows the FM Approvals available at the time of printing. Check with the manufacturer for any additional approvals.
[5] Other colors are available on request with the same Approvals as the standard colors.
[6] FM approved as corrosion resistant.

DESIGN CRITERIA - FM

(Also refer to Approval Chart 2 above.)

FM Approval Requirements:

The Microfast® Quick Response Upright Sprinkler VK300 is FM Approved as a quick response **Non-Storage** upright sprinkler as indicated in the FM Approval Guide. For specific application and installation requirements, reference the latest applicable FM Loss Prevention Data Sheets (including Data Sheet 2-0). FM Global Loss Prevention Data Sheets contain guidelines relating to, but not limited to: minimum water supply requirements, hydraulic design, ceiling slope and obstructions, minimum and maximum allowable spacing, and deflector distance below the ceiling.

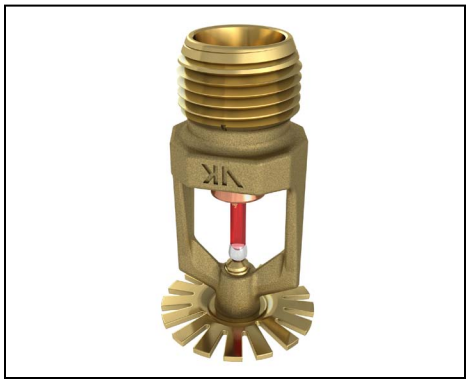
NOTE: The FM installation guidelines may differ from cULus and/or NFPA criteria.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to Form No. F_080614 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

VIKING®	TECHNICAL DATA	MICROFAST® QUICK RESPONSE PENDENT SPRINKLER VK302 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
Visit the Viking website for the latest edition of this technical data page: www.vikinggroupinc.com

1. DESCRIPTION



The Viking Microfast® Quick Response Pendent Sprinkler VK302 is a small thermo-sensitive glass bulb spray sprinkler available with various finishes and temperature ratings to meet design requirements. The special Polyester and Electroless Nickel PTFE (ENT) coatings can be used in decorative applications where colors are desired. In addition, these coatings have been investigated for installation in corrosive atmospheres and are listed/approved as corrosion resistant as indicated in the Approval Charts. (Note: **FM Global approves ENT finish as corrosion resistant.** FM Global has no approval classification for Polyester coatings as corrosion resistant.)

2. LISTINGS AND APPROVALS

cULus Listed: Category VNIV

FM Approved: Class Series 2000

VdS Approved: Certificates G414009 and G414010

LPCB Approved

CE Certified: Standard EN 12259-1:1999, A3:2006 Certificate of Constancy of Performance 0832-CPR-S0021

CCCF Approved: Approved by the China Certification Center for Fire Products (CCCF)

Refer to Approval Charts and Design Criteria for listing and approval requirements that must be followed.

3. TECHNICAL DATA

Specifications:
Minimum Operating Pressure: 7 psi (0.5 bar)
Rated to 175 psi (12 bar) water working pressure
Factory tested hydrostatically to 500 psi (34.5 bar)
Thread size: 1/2” NPT, 15 mm BSP
Nominal K-Factor: 5.6 U.S. (80.6 metric**)
Glass-bulb fluid temperature rated to -65 °F (-55 °C)
Overall Length: 2-1/4” (58 mm)

*cULus Listing, FM Approval, and NFPA 13 installs require a minimum of 7 psi (0.5 bar). The minimum operating pressure for LPCB and CE Approvals ONLY is 5 psi (0.35 bar).

Material Standards:
Frame Casting: Brass UNS-C84400 or QM Brass
Deflector: Phosphor Bronze UNS-C51000 or Copper UNS-C19500
Bulb: Glass, nominal 3 mm diameter
Belleville Spring Sealing Assembly: Nickel Alloy, coated on both sides with PTFE Tape
Screw: Brass UNS-C36000
Pip Cap and Insert Assembly: Copper UNS-C11000 and Stainless Steel UNS-S30400
For Polyester Coated Sprinklers: Belleville Spring-Exposed
For ENT Coated Sprinklers: Belleville Spring-Exposed, Screw and Pipcap - ENT plated.

Ordering Information: (Also refer to the current Viking price list.)
Order Quick Response Pendent Sprinklers by first adding the appropriate suffix for the sprinkler finish and then the appropriate suffix for the temperature rating to the sprinkler base part number.
Finish Suffix: Brass = A, Chrome = F, White Polyester = M-/W, Black Polyester = M-/B, and ENT = JN
Temperature Suffix: 135 °F (57 °C) = A, 155 °F (68 °C) = B, 175 °F (79 °C) = D, 200 °F (93 °C) = E, 286 °F (141 °C) = G
For example, sprinkler VK302 with a Brass finish and a 155 °F (68 °C) temperature rating = Part No. 12979AB
Available Finishes And Temperature Ratings: Refer to Table 1.
Accessories: (Also refer to the current Viking price list.)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
Visit the Viking website for the latest edition of this technical data page: www.vikinggroupinc.com

Sprinkler Wrenches:

A. Standard Wrench: Part No. 21475M/B (available since 2017).
B. Wrench for Recessed Pendent Sprinklers: Part No. 13655W/B** (available since 2006)
C. Optional Protective Sprinkler Cap Remover/Escutcheon Installer Tool*** Part No. 15915 (available since 2010)

**A ½" ratchet is required (not available from Viking).

***Allows use from the floor by attaching a length of 1" diameter CPVC tubing to the tool. Ideal for sprinkler cabinets. Refer to Bulletin F_051808.

Sprinkler Cabinets:

A. Six-head capacity: Part No. 01724A (available since 1971)
B. Twelve-head capacity: Part No. 01725A (available since 1971)

4. INSTALLATION

Refer to appropriate NFPA Installation Standards.

5. OPERATION

During fire conditions, the heat-sensitive liquid in the glass bulb expands, causing the glass to shatter, releasing the pip cap and sealing spring assembly. Water flowing through the sprinkler orifice strikes the sprinkler deflector, forming a uniform spray pattern to extinguish or control the fire.

6. INSPECTIONS, TESTS AND MAINTENANCE

Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

7. AVAILABILITY

The Viking Microfast® Quick Response Pendent Sprinkler VK302 is available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

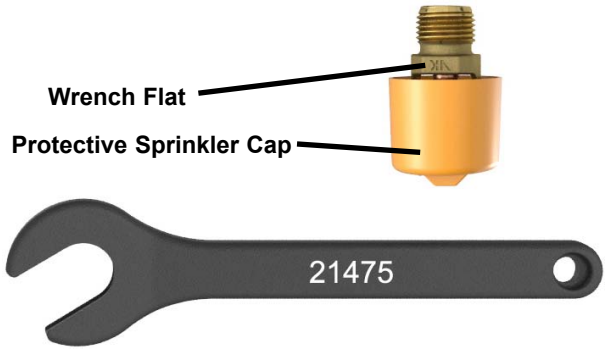


Figure 1:
Standard Sprinkler Wrench 21475M/B

VIKING®

TECHNICAL DATA

MICROFAST® QUICK RESPONSE PENDENT SPRINKLER VK302 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
Visit the Viking website for the latest edition of this technical data page: www.vikinggroupinc.com

TABLE 1: AVAILABLE SPRINKLER TEMPERATURE RATINGS AND FINISHES

Sprinkler Temperature Classification	Sprinkler Nominal Temperature Rating[1]	Maximum Ambient Ceiling Temperature[2]	Bulb Color
Ordinary	135 °F (57 °C)	100 °F (38 °C)	Orange
Ordinary	155 °F (68 °C)	100 °F (38 °C)	Red
Intermediate	175 °F (79 °C)	150 °F (65 °C)	Yellow
Intermediate	200 °F (93 °C)	150 °F (65 °C)	Green
High	286 °F (141 °C)	225 °F (107 °C)	Blue

Sprinkler Finishes: Brass, Chrome, White Polyester, Black Polyester, and ENT

Corrosion-Resistant Coatings[3]: White Polyester, and Black Polyester. ENT in all temperature ratings except 135 °F (57 °C)

Footnotes

[1] The sprinkler temperature rating is stamped on the deflector.

[2] Based on NFPA-13. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.

[3] The corrosion-resistant coatings have passed the standard corrosion test required by the approving agencies indicated in the Approval Charts. These tests cannot and do not represent all possible corrosive environments. Prior to installation, verify through the end-user that the coatings are compatible with or suitable for the proposed environment. For automatic sprinklers, the coatings indicated are applied to the exposed exterior surfaces only. Note that the spring is exposed on sprinklers with Polyester and ENT coatings. For ENT coated automatic sprinklers, the waterway is coated.

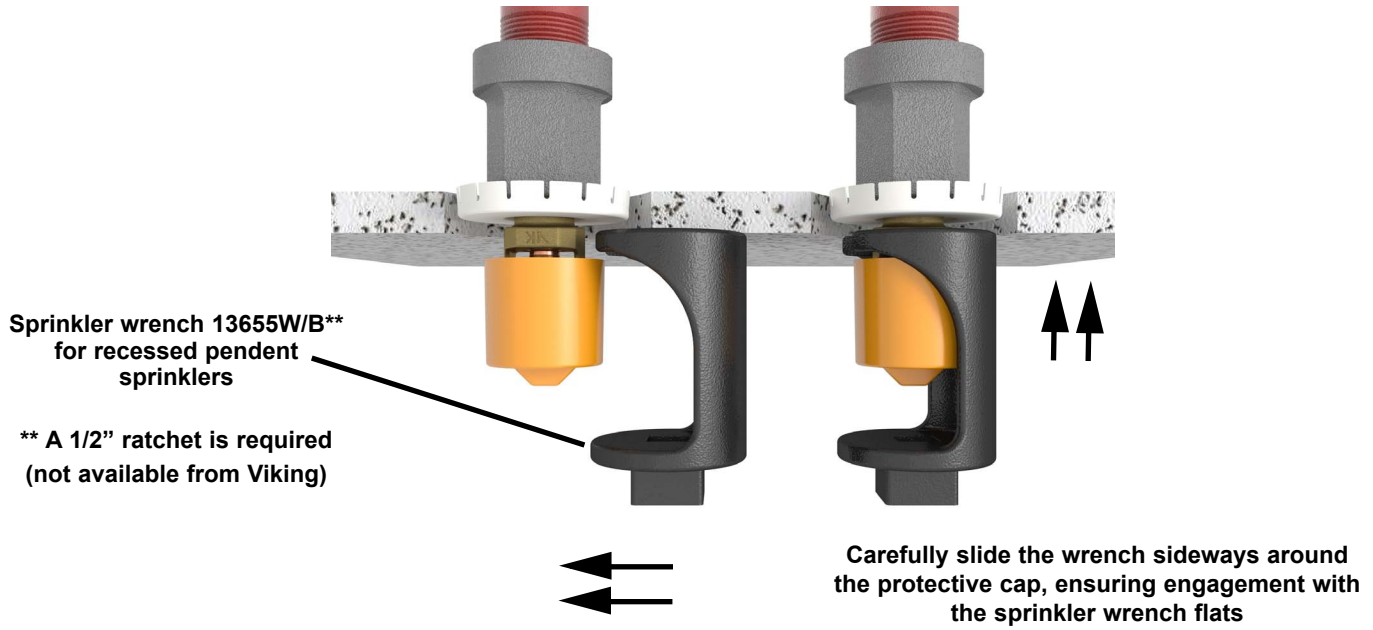


Figure 2: Wrench 13655W/B for Recessed Pendent Sprinklers

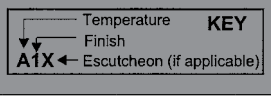
TECHNICAL DATA

MICROFAST® QUICK RESPONSE PENDENT SPRINKLER VK302 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
Visit the Viking website for the latest edition of this technical data page: www.vikinggroupinc.com

Approval Chart 1 (UL)

The Viking Microfast® Quick Response Pendent Sprinkler VK302
Maximum 175 PSI (12 Bar) WWP



Base Part Number[1]	SIN	Sprinkler Style	Thread Size		Nominal K-Factor		Overall Length		Listings and Approvals[3] (Refer also to Design Criteria.)					
			NPT	BSP	U.S.	metric[2]	Inches	mm	cULus[4]	VdS	LPCB	CE[7]		
12979	VK302	Pendent	1/2”	15 mm	5.6	80.6	2-1/4	58	A1Z, B1Y, D2, C2X	A1	A1Z, B1Y	D1Z, C1Y	--	--
19780	VK302	Pendent	1/2”	--	5.6	80.6	2-1/4	58	--	--	--	--	--	D3
21354	VK302	Pendent	--	15 mm	5.6	80.6	2-1/4	58	--	--	--	--	--	D3
NOTICE - Product Below - Limited Availability (Contact Local Viking Office)														
06662B	VK302	Pendent	1/2”	15 mm	5.6	80.6	2-1/4	58	A1Z, B1Y, D2, C2X	--	--	--	--	--
18021	VK302	Pendent	1/2”	15 mm	5.6	80.6	2-1/4	58	A1X, B1Y	A1	A1X, B1Y	D1X, C1Y[8]	D1X, C1Y[9]	--

Approved Temperature Ratings

A - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), 286 °F (141 °C)
B - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), and 200 °F (93 °C)
C - 155 °F (68 °C), 175 °F (79 °C), and 200 °F (93 °C)
D - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), 286 °F (141 °C)

Approved Finishes

1 - Brass, Chrome, White Polyester[5,6], Black Polyester[5,6]
2 - ENT[5]
3 - Chrome

Approved Escutcheons

X - Standard surface-mounted escutcheon or the Viking Micromatic® Model E-1 Recessed Escutcheon
Y - Standard surface-mounted escutcheon or the Viking Microfast® Model F-1 Adjustable Escutcheon, or recessed with the Viking Micromatic® Model E-1, E-2, or E-3 Recessed Escutcheon
Z - Standard surface-mounted escutcheon or the Viking Microfast® Model F-1 Adjustable Escutcheon

Footnotes

[1] Base part number shown. For complete part number, refer to Viking’s current price schedule.
[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.
[3] This table shows the listings and approvals available at the time of printing. Other approvals may be in process.
[4] Listed by Underwriters Laboratories Inc. for use in the U.S. and Canada.
[5] cULus Listed as corrosion-resistant.
[6] Other colors are available on request with the same Listings and Approvals as the standard colors.
[7] CE Certified, Standard EN 12259-1, EC-certificate of conformity 0832-CPD-2001.
[8] CE Certified, Standard EN 12259-1, EC-certificates of conformity 0832-CPD-2001 and 0832-CPD-2003.
[9] MED Certified, Standard EN 12259-1, EC-certificates of conformity 0832-MED-1003 and 0832-MED-1008.

DESIGN CRITERIA - UL

(Also refer to Approval Chart 1 above.)

cULus Listing Requirements:

The Viking Microfast® Quick Response Pendent Sprinkler VK302 is cULus Listed as indicated in the Approval Chart for installation in accordance with the latest edition of NFPA 13 for standard spray sprinklers.

- Designed for use in Light and Ordinary occupancies.
- The sprinkler installation rules contained in NFPA 13 for standard spray pendent sprinklers must be followed.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to Form No. F_080614 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

VIKING®

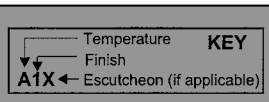
TECHNICAL DATA

MICROFAST® QUICK RESPONSE PENDENT SPRINKLER VK302 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
Visit the Viking website for the latest edition of this technical data page: www.vikinggroupinc.com

Approval Chart 2 (FM)

The Viking Microfast® Quick Response Pendent Sprinkler VK302
Maximum 175 PSI (12 Bar) WWP



Base Part Number[1]	SIN	Sprinkler Style	Thread Size		Nominal K-Factor		Overall Length		FM Approvals[3] (Refer also to Design Criteria.)
			NPT	BSP	U.S.	metric[2]	Inches	mm	
12979	VK302	Pendent	1/2”	15 mm	5.6	80.6	2-1/4	58	A1Z, B1Y, D2X, C2
NOTICE - Product Below - Limited Availability (Contact Local Viking Office)									
06662B	VK302	Pendent	1/2”	15 mm	5.6	80.6	2-1/4	58	A1Z, B1Y, D2X, C2
18021	VK302	Pendent	1/2”	15 mm	5.6	80.6	2-1/4	58	A1Z, B1Y

Approved Temperature Ratings

A - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), 286 °F (141 °C)
B - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), and 200 °F (93 °C)
C - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), 286 °F (141 °C)
D - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C)

Approved Finishes

1 - Brass, Chrome, White Polyester[4], and Black Polyester[4]
2 - ENT[5]

Approved Escutcheons

X - Standard surface-mounted escutcheon or the Viking Micromatic® Model E-1 Recessed Escutcheon
Y - Standard surface-mounted escutcheon or the Viking Microfast® Model F-1 Adjustable Escutcheon, or recessed with the Viking Micromatic® Model E-1 or E-2 Recessed Escutcheon
Z - Standard surface-mounted escutcheon or the Viking Microfast® Model F-1 Adjustable Escutcheon

Footnotes

[1] Base part number shown. For complete part number, refer to Viking’s current price schedule.

[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

[3] This table shows the FM Approvals available at the time of printing. Other approvals may be in process.

[4] Other colors are available on request with the same Approvals as the standard colors.

[5] FM approved as corrosion resistant.

DESIGN CRITERIA - FM

(Also refer to Approval Chart 2 above.)

FM Approval Requirements:

The Viking Microfast® Quick Response Pendent Sprinkler VK302 is FM Approved as quick response **Non-storage** pendent sprinklers as indicated in the FM Approval Guide. For specific application and installation requirements, reference the latest applicable FM Loss Prevention Data Sheets (including Data Sheet 2-0). FM Global Loss Prevention Data Sheets contain guidelines relating to, but not limited to: minimum water supply requirements, hydraulic design, ceiling slope and obstructions, minimum and maximum allowable spacing, and deflector distance below the ceiling.

NOTE: The FM installation guidelines may differ from cULus and/or NFPA criteria.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to page F_080614 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

VIKING®

TECHNICAL DATA

MICROFAST® QUICK RESPONSE PENDENT SPRINKLER VK302 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
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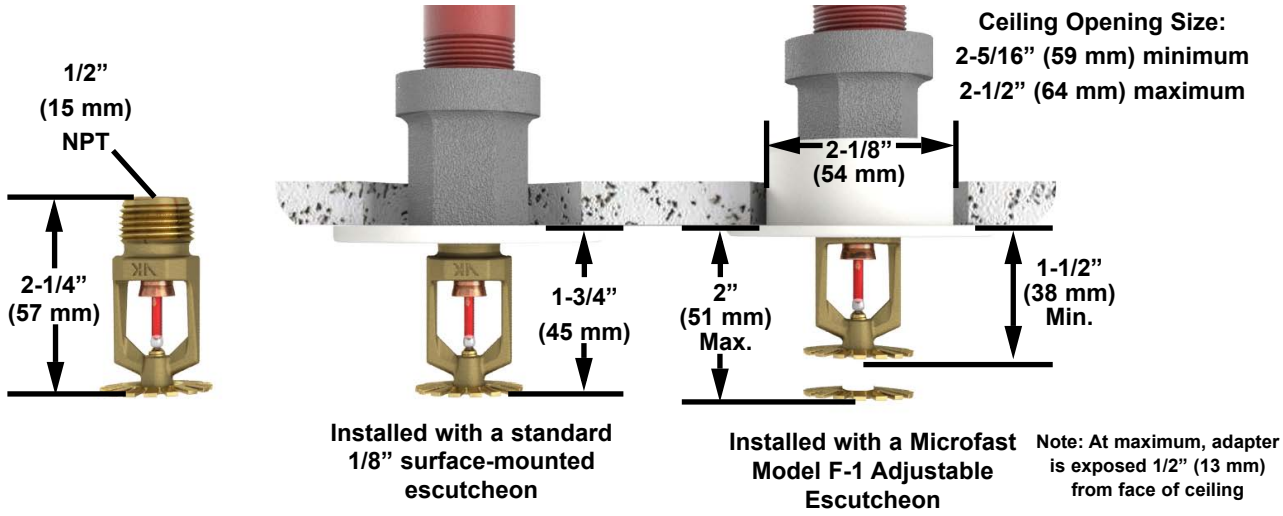

Figure 3: Sprinkler Dimensions with a Standard Escutcheon and the Model F-1 Adjustable Escutcheon

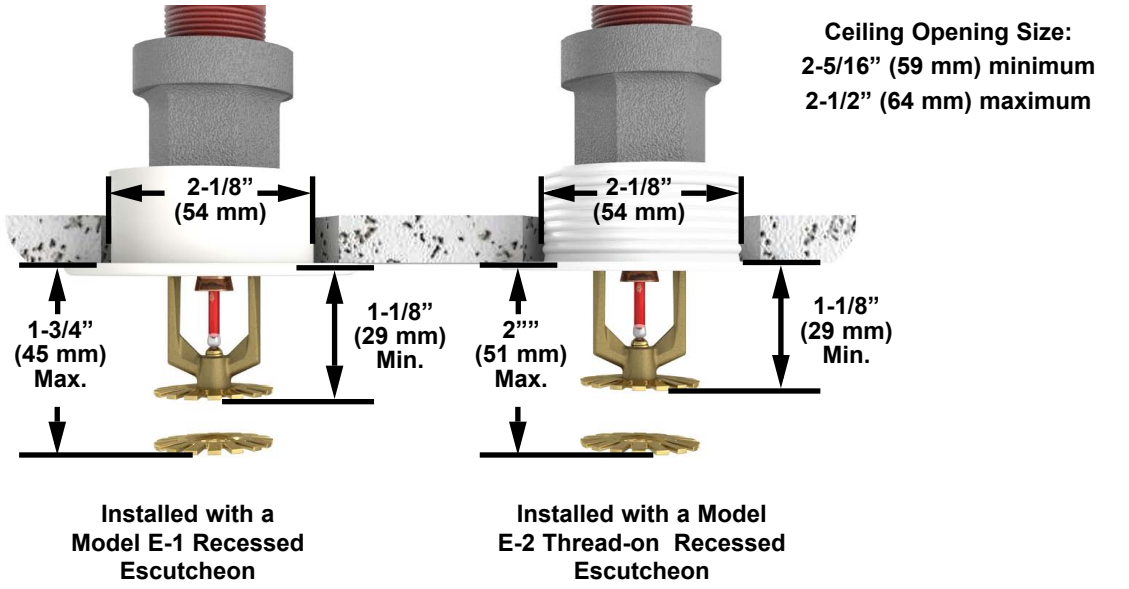

Figure 4: Sprinkler Dimensions with the Model E-1 and E-2 Recessed Escutcheons

TECHNICAL DATA

MICROFAST® QUICK RESPONSE HORIZONTAL SIDEWALL SPRINKLER VK305 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
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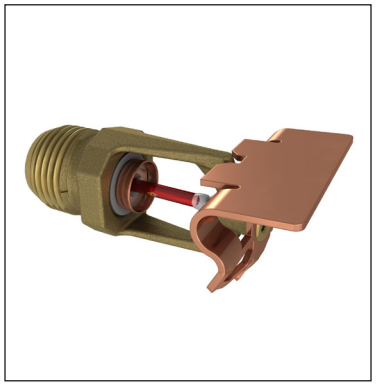
1. DESCRIPTION

The Viking Microfast® Quick Response Horizontal Sidewall Sprinkler VK305 is a small thermosensitive glass bulb spray sprinkler available with various finishes and temperature ratings to meet design requirements. The special Polyester and Electroless Nickel PTFE (ENT) coatings can be used in decorative applications where colors are desired. In addition, these coatings have been investigated for installation in corrosive atmospheres and are listed/approved as corrosion resistant as indicated in Approval Charts.



WARNING: Cancer and Reproductive Harm- www.P65Warnings.ca.gov

2. LISTINGS AND APPROVALS

cULus Listed: Category VNIV

FM Approved: Class 2020

CCCF Approved: Approved by the China Certification Center for Fire Products (CCCF)

Refer to Approval Charts and Design Criteria for listing and approval requirements that must be followed.

3. TECHNICAL DATA

Specifications:

Minimum Operating Pressure: 7 psi (0.5 bar)
Rated to 175 psi (12 bar) water working pressure
Factory tested hydrostatically to 500 psi (34.5 bar)
Nominal K-Factor: 5.6 U.S. (80.6 metric*)

* Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

Overall Length: 2-3/4" (68 mm)

Material Standards:

Frame Casting: Brass UNS-C84400 or QM Brass
Deflector: Copper UNS-C19500
Bulb: Glass, nominal 3 mm diameter
Belleville Spring Sealing Assembly: Nickel Alloy, coated on both sides with PTFE Tape
Screw: Brass UNS-C36000
Pip Cap and Insert Assembly: Copper UNS-C11000 and Stainless Steel UNS-S30400
For Polyester Coated Sprinklers: Belleville Spring-Exposed
For ENT Coated Sprinklers: Belleville Spring - Exposed, Screw and Pip cap - ENT plated.

Ordering Information: (Also refer to the current Viking price list.)

Order Viking Microfast® Quick Response Horizontal Sidewall Sprinkler VK305 by first adding the appropriate suffix for the sprinkler finish and then the appropriate suffix for the temperature rating to the sprinkler base part number.
Finish Suffix: Brass = A, Chrome = F, White Polyester = M-/W, Black Polyester = M-/B, and ENT = JN
Temperature Suffix: 135 °F / 57 °C = A, 155 °F / 68 °C = B, 175 °F / 79 °C = D, 200 °F / 93 °C = E, and 286 °F / 141 °C = G
For example, sprinkler 12997 with a Brass finish and a 155 °F / 68 °C temperature rating = Part No. 12997AB

Available Finishes And Temperature Ratings: Refer to Table 1.

Accessories: (Also refer to the Viking website.)

Sprinkler Wrenches:

A. Standard Wrench: Part No. 21475M/B (available since 2017).
B. Wrench for recessed and/or wax coated sprinklers: Part No. 13655W/B** (available since 2006)
**A ½" ratchet is required (not available from Viking).

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
Visit the Viking website for the latest edition of this technical data page: www.vikinggroupinc.com

Sprinkler Cabinets:

A. Six-head capacity: Part No. 01724A (available since 1971)
B. Twelve-head capacity: Part No. 01725A (available since 1971)

4. INSTALLATION

Refer to appropriate NFPA Installation Standards.

5. OPERATION

During fire conditions, the heat-sensitive fusible link disengages, the pip cap and spring are released, and the waterway is opened. Water flowing through the sprinkler orifice strikes the sprinkler deflector, forming a uniform spray pattern to extinguish or control the fire.

6. INSPECTIONS, TESTS AND MAINTENANCE

Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

7. AVAILABILITY

Viking Microfast® Quick Response Horizontal Sidewall Sprinkler VK305 is available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

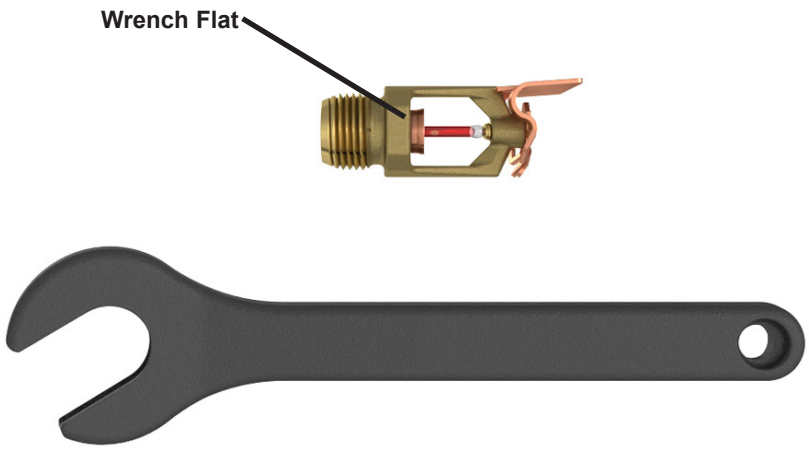


Figure 1:
Standard Sprinkler Wrench 21475M/B

VIKING	TECHNICAL DATA	MICROFAST® QUICK RESPONSE HORIZONTAL SIDEWALL SPRINKLER VK305 (K5.6)

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TABLE 1: AVAILABLE SPRINKLER TEMPERATURE RATINGS AND FINISHES

Sprinkler Temperature Classification	Sprinkler Nominal Temperature Rating[1]	Maximum Ambient Ceiling Temperature[2]	Bulb Color
Ordinary	135 °F (57 °C)	100 °F (38 °C)	Orange
Ordinary	155 °F (68 °C)	100 °F (38 °C)	Red
Intermediate	175 °F (79 °C)	150 °F (65 °C)	Yellow
Intermediate	200 °F (93 °C)	150 °F (65 °C)	Green
High	286 °F (141 °C)	225 °F (107 °C)	Blue

Sprinkler Finishes: Brass, Chrome, White Polyester, Black Polyester, and ENT

Corrosion-Resistant Coatings[3]: White Polyester, Black Polyester, and ENT

Footnotes

[1] The sprinkler temperature rating is stamped on the deflector.

[2] Based on NFPA-13. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.

[3] The corrosion-resistant coatings have passed the standard corrosion test required by the approving agencies indicated in the Approval Charts. These tests cannot and do not represent all possible corrosive environments. Prior to installation, verify through the end-user that the coatings are compatible with or suitable for the proposed environment. For automatic sprinklers, the coatings indicated are applied to the exposed exterior surfaces only. For ENT coated sprinklers, the waterway is coated. Note that the spring is exposed on sprinklers with Polyester, and ENT coatings.

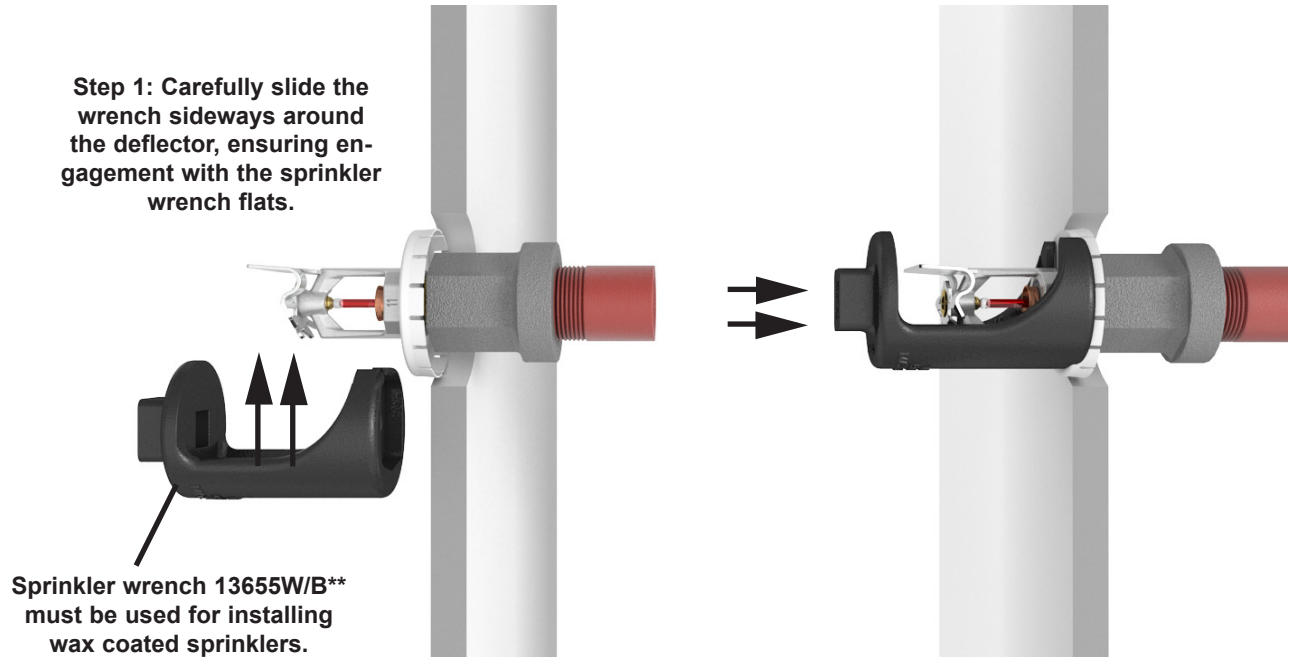

Figure 2: Wrench 13655W/B for Recessed Sprinklers

TECHNICAL DATA

MICROFAST® QUICK RESPONSE HORIZONTAL SIDEWALL SPRINKLER VK305 (K5.6)

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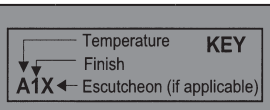
Approval Chart 1 (UL)

Microfast® Quick Response Horizontal Sidewall Sprinkler VK305
For Light or Ordinary Hazard Occupancies
Maximum 175 PSI (12 Bar) WWP
Deflector must be located 4" to 12" (102 mm to 305 mm) below the ceiling.



Base Part Number[1]	SIN	Sprinkler Style	Thread Size		Nominal K-Factor		Overall Length		Listings and Approvals[3] (Refer also to Design Criteria on page 43x.)			
			NPT	BSP	U.S.	metric[2]	Inches	mm	cULus[4]	LPCB	CE	RCM
12997	VK305	HSW	1/2"	15 mm	5.6	80.6	2-11/16	68	A1W, B1X, C2W, D2Z	--	--	--
19782	VK305	HSW	1/2"	--	5.6	80.6	2-11/16	68	--	--	--	E3
NOTICE - Product Below - Limited Availability (Contact Local Viking Office)												
12121	VK305	HSW	1/2"	15 mm	5.6	80.6	1-11/16	68	A1W, B1X, C2W, D2Z	--	--	--

Approved Temperature Ratings

A - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141 °C)
B - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), and 200 °F (93 °C)
C - 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141 °C)
D - 155 °F (68 °C), 175 °F (79 °C), and 200 °F (93 °C)
E - 155 °F (68 °C)

Approved Finishes

1 - Brass, Chrome, White Poly-ester[5,6], and Black Polyester[5,6]
2 - ENT[5]
3 - Chrome

Approved Escutcheons

W - Installed with standard surface-mounted escutcheons
X - Installed with standard surface-mounted escutcheons **or** recessed with the Viking Micromatic® Model E-1, E-2, or G-1 Recessed Escutcheon
Z - Installed with standard surface-mounted escutcheons or recessed with the Viking Micromatic Model E-1

Footnotes

[1] Base part number shown. For complete part number, refer to Viking's current price schedule.
[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.
[3] This table shows the listings and approvals available at the time of printing. Other approvals may be in process.
[4] Listed by Underwriters Laboratories Inc. for use in the U.S. and Canada.
[5] cULus Listed as corrosion-resistant.
[6] Other colors are available on request with the same Listings and Approvals as the standard colors.

DESIGN CRITERIA - UL

(Also refer to Approval Chart 1.)

cULus Listing Requirements:

Quick Response Horizontal Sprinkler VK305 is cULus Listed as indicated in Approval Chart 1 for installation in accordance with the latest edition of NFPA 13 for sidewall standard spray sprinklers.

- Designed for use in Light and Ordinary Hazard occupancies.
- Locate with the deflector 4" to 12" (102 mm to 305 mm) below the ceiling.
- Protection areas and maximum spacing shall be in accordance with the tables provided in NFPA 13.
- Minimum spacing allowed is 6 ft. (1.8 m).
- Align the top of the deflector parallel with the ceiling.
- Locate no less than 4" (102 mm) from end walls.
- Maximum distance from end walls shall be no more than one-half of the allowable distance between sprinklers. The distance shall be measured perpendicular to the wall.
- The sprinkler installation and obstruction rules contained in NFPA 13 for sidewall standard spray sprinklers must be followed.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to Bulletin Form No. F_080614 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

VIKING	TECHNICAL DATA	MICROFAST® QUICK RESPONSE HORIZONTAL SIDEWALL SPRINKLER VK305 (K5.6)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
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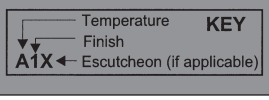
Approval Chart 2 (FM)

Quick Response Sidewall Sprinklers
Maximum 175 PSI WWP



Base Part Number[1]	SIN	Thread Size		Nominal K-Factor		Overall Length		FM Approvals[3,4] (Refer also to Design Criteria below.)
		NPT	BSP	U.S.	metric[2]	Inches	mm	
12997	VK305	1/2”	15 mm	5.6	80.6	2-11/16	68	A1Y, B1X
NOTICE - Product Below - Limited Availability (Contact Local Viking Office)								
12121	VK305	1/2”	15 mm	5.6	80.6	2-11/16	68	A1Y, B1X

Approved Temperature Ratings

A - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), 200 °F (93 °C), and 286 °F (141 °C)
B - 135 °F (57 °C), 155 °F (68 °C), 175 °F (79 °C), and 200 °F (93 °C)

Approved Finishes

1 - Brass

Approved Escutcheons

X - Installed with standard surface-mounted escutcheons **or** recessed with the Viking Micromatic® Model E-1, E-2, E-3, or G-1 Recessed Escutcheon
Y - Installed with standard surface-mounted escutcheons

Footnotes

[1] Base part number shown. For complete part number, refer to Viking’s current price schedule.
[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.
[3] This table shows the FM Approvals available at the time of printing. Other approvals may be in process.
[4] Viking vertical sidewall sprinklers may be installed pendent or upright.

DESIGN CRITERIA - FM

(Also refer to Approval Chart 2 above.)

FM Approval Requirements:

Horizontal Sidewall Sprinkler VK305 is FM Approved as a quick response **Non-Storage** sidewall sprinkler as indicated in the FM Approval Guide. For specific application and installation requirements, reference the latest applicable FM Loss Prevention Data Sheets (including Data Sheet 2-0). FM Global Loss Prevention Data Sheets contain guidelines relating to, but not limited to: minimum water supply requirements, hydraulic design, ceiling slope and obstructions, minimum and maximum allowable spacing, and deflector distance below the ceiling.

NOTE: The FM installation guidelines may differ from cULus and/or NFPA criteria.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to Bulletin Form No. F_080614 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

MICROFAST® QUICK RESPONSE HORIZONTAL SIDEWALL SPRINKLER VK305 (K5.6)

TECHNICAL DATA

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
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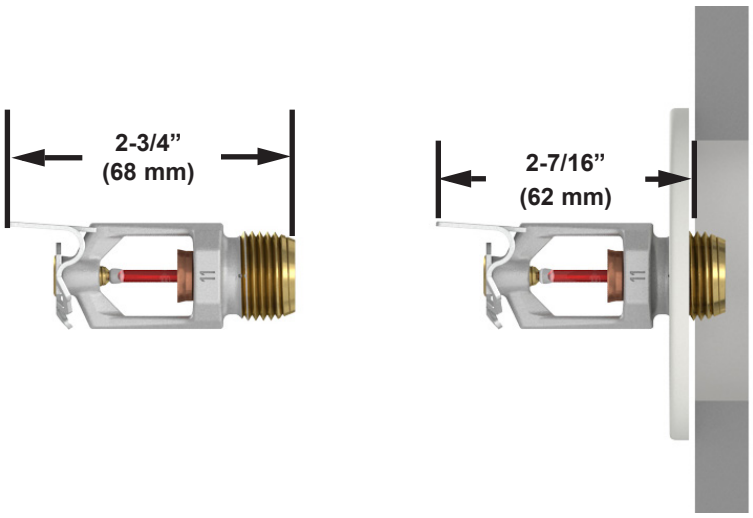
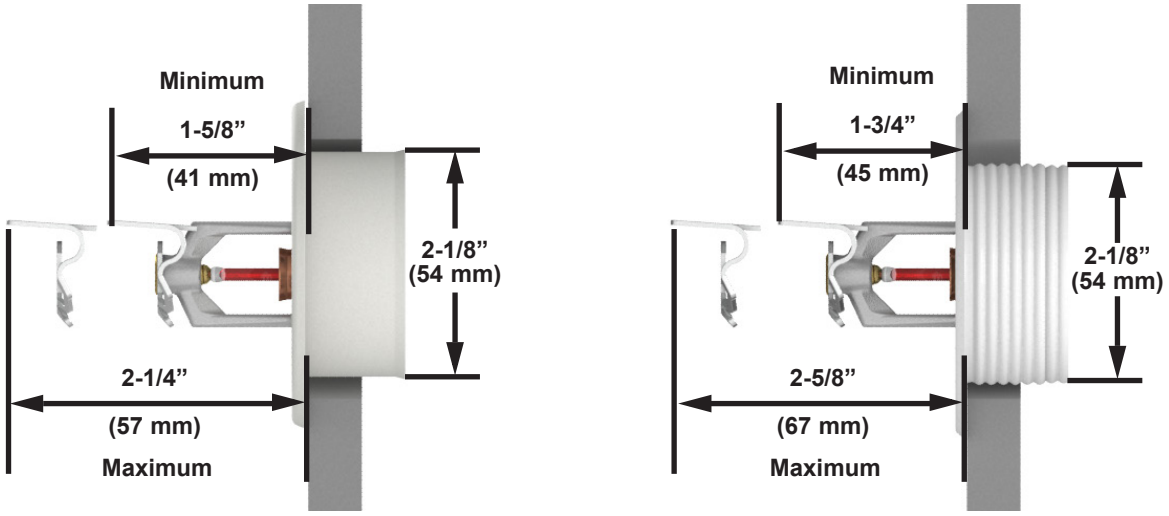


Wall Opening Size:
2-5/16” (58.7 mm) minimum
2-1/2” (63.5 mm) maximum

Installed with a Standard 1/8” Surface-Mounted Escutcheon

Figure 3: Sidewall Sprinkler Dimensions with a Standard Escutcheon



Wall Opening Size:
2-5/16” (58.7 mm) minimum
2-1/2” (63.5 mm) maximum

Installed with the Micromatic Model E-1 Recessed Escutcheon

Installed with the Threaded Model E-2 Recessed Escutcheon

Figure 4: Sidewall Sprinkler VK305 Dimensions with the Model E-1 and E-2 Recessed Escutcheons

TECHNICAL DATA

STANDARD/QUICK RESPONSE EXTENDED COVERAGE LIGHT HAZARD ELO PENDENT SPRINKLER VK608

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
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1. DESCRIPTION

The Viking Standard/Quick Response Extended Coverage Light Hazard Extra-Large Orifice (ECLH-ELO/QRECLH-ELO) Pendent Sprinkler VK608 is a thermo-sensitive spray sprinkler available in several different finishes and temperature ratings to meet varying design requirements. The glass bulb operating element and special deflector characteristics meet the challenges of quick response extended coverage standards. The sprinkler has both quick response and standard response listings as indicated in the Approval Charts on pages 3-4. The special Polyester and Electroless Nickel PTFE (ENT) coatings can be used in decorative applications where colors are desired. In addition, the ENT coating has been investigated for installation in corrosive atmospheres. Refer to the Approval Charts.

For Light Hazard Occupancies

NOTE: As of May 2018 all logos have been removed from the wrench boss.

WARNING: Cancer and Reproductive Harm- www.P65Warnings.ca.gov

2. LISTINGS AND APPROVALS

cULus Listed: Category VNIV

FM Approved: Class 2020

NYC Approved: MEA 89-92-E, Volume 9

Refer to Approval Chart 1 and Design Criteria on pages 3-4 for cULus Listing requirements, and refer to Approval Chart 2 and Design Criteria on page 5 for FM Approval requirements that must be followed.

3. TECHNICAL DATA

Specifications:

Available since 1993.
Minimum Operating Pressure: Refer to the Approval Charts.
Maximum Working Pressure: 175 psi (12 Bar). Factory tested hydrostatically to 500 psi (34.5 bar).
Factory tested hydrostatic rating: 500 psi (34.5 bar).
Thread size: 3/4” NPT (20 mm)
Nominal K-Factor: 11.2 U.S. (161.3 metric†)

† Metric K-factor measurement shown is in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

Glass-bulb fluid temperature rating: -65 °F (-55 °C)
Overall Length: 2-5/16” (59 mm)

Material Standards:

Sprinkler Frame: Brass UNS-C84400
Deflector: Brass UNS-C51000
Bulb: Glass, nominal 3 mm diameter
Belleville Spring Sealing Assembly: Nickel Alloy, coated on both sides with PTFE Tape
Screw: Brass UNS-C36000
Pip Cap and Insert Assembly: Leaded Bronze UNS-C31600 or UNS-C31400
For Polyester Coated Sprinklers: Belleville Spring-Exposed
For ENT Coated Sprinkler: Belleville Spring-Exposed, Screw and Pipcap-ENT plated.

Ordering Information: (Also refer to the current Viking price list.)

Order Standard/Quick Response Extended Coverage Light Hazard Extra-Large Orifice (ECLH-ELO) Pendent Sprinkler VK608 by first adding the appropriate suffix for the sprinkler finish and then the appropriate suffix for the temperature rating to the sprinkler base part number.
Finish Suffixes: Brass = A, Chrome = F, White Polyester = M-/W, Black Polyester = M-/B, and ENT=JN
Temperature Suffixes: 135 °F (57 °C) = A, 155 °F (68 °C) = B, 175 °F (79 °C) = D
For example, sprinkler VK608 with a Brass finish and a 155 °F (68 °C) temperature rating = Part No. 08339AB

Available Finishes And Temperature Ratings: Refer to Table 1.

Accessories: (Also refer to the the current Viking price list.)

VIKING®

TECHNICAL DATA

STANDARD/QUICK RESPONSE EXTENDED COVERAGE LIGHT HAZARD ELO PENDENT SPRINKLER VK608

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
Visit the Viking website for the latest edition of this technical data page www.vikinggroupinc.com.

Sprinkler Wrenches:

A. Standard Wrench: Part No. 05118CW/B (available since 1981)
B. Wrench for recessed pendent sprinkler: Part No. 11663W/B** (available since 2001)
**A ½" ratchet is required (not available from Viking).

Sprinkler Cabinets:

A. Six-head capacity: Part No. 01724A (available since 1971)
B. Twelve-head capacity: Part No. 01725A (available since 1971)

4. INSTALLATION

Refer to the appropriate NFPA and FM Installation Standards.

5. OPERATION

During fire conditions, the heat-sensitive liquid in the glass bulb expands, causing the glass to shatter, releasing the pip cap and sealing spring assembly. Water flowing through the sprinkler orifice strikes the sprinkler deflector, forming a uniform spray pattern to extinguish or control the fire.

6. INSPECTIONS, TESTS AND MAINTENANCE

Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

7. AVAILABILITY

Viking Sprinkler VK608 is available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

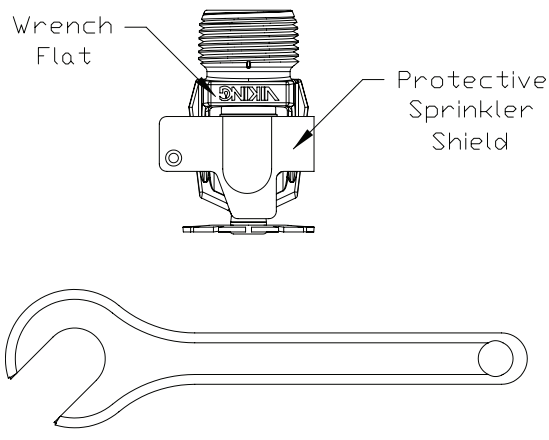

Figure 1:
Standard Sprinkler Wrench 05118CW/B

TABLE 1: AVAILABLE SPRINKLER TEMPERATURE RATINGS AND FINISHES

Sprinkler Temperature Classification	Sprinkler Nominal Temperature Rating[1]	Maximum Ambient Ceiling Temperature[2]	Bulb Color
Ordinary	135 °F (57 °C)	100 °F (38 °C)	Orange
Ordinary	155 °F (68 °C)	100 °F (38 °C)	Red
Intermediate	175 °F (79 °C)	150 °F (65 °C)	Yellow

Sprinkler Finishes: Brass, Chrome, White Polyester[3], Black Polyester[3], and ENT[3,4]

Corrosion-Resistant Coatings[4]: ENT

Footnotes

[1] The sprinkler temperature rating is stamped on the deflector.

[2] Based on NFPA-13. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.

[3] For automatic sprinklers, the coatings indicated are applied to the exposed exterior surfaces only. Note that the spring is exposed on sprinklers with Polyester and ENT coatings. For ENT automatic sprinklers, the waterway is coated.

[4] The corrosion-resistant coatings have passed the standard corrosion test required by the approving agencies indicated in the Approval Chart. These tests do not represent all possible corrosive environments. Prior to installation, verify through the end-user that the coatings are compatible with or suitable for the proposed environment. For ENT automatic sprinklers, all exposed surfaces and the waterway are coated, but note that the spring is exposed.

TECHNICAL DATA

STANDARD/QUICK RESPONSE EXTENDED COVERAGE LIGHT HAZARD ELO PENDENT SPRINKLER VK608

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
Visit the Viking website for the latest edition of this technical data page www.vikinggroupinc.com.

Sprinkler Base Part Number[1]	SIN	NPT Thread Size		Nominal K-Factor		Maximum Water Working Pressure	Overall Length	
		Inches	mm	U.S.	metric[2]		Inches	mm
08339	VK608	3/4	20	11.2	161.3	175 psi (12 Bar)	2-5/16	59

Approval Chart 1 (UL)
Standard/Quick Response Extended Coverage ELO Pendent Sprinkler VK608
For Light Hazard Occupancies

KEY: A1X ← Temperature, Finish, Escutcheon (if applicable)

Maximum Sprinkler Spacing (L x W[4])	Maximum Area per Sprinkler	Minimum Water Supply Requirements[4]	Listings and Approvals[3] (Refer also to Design Criteria on page 4.)	
			cULus[5]	NYC[7]
Standard Response[6]				
20 ft. x 20 ft. (6.1 m x 6.1 m)	400 ft² (37.2 m²)	40 gpm @ 12.8 psi (151.4 L/min @ .88 Bar)	C1Y, C2Z	C1Y
Quick Response				
16 ft. x 16 ft. (4.9 m x 4.9 m)	256 ft² (23.8 m²)	30 gpm @ 7.2 psi (113.6 L/min @ .50 Bar)	A1Y, A2Z	See Footnote 8.
18 ft. x 18 ft. (5.5 m x 5.5 m)	324 ft² (30.1 m²)	33 gpm @ 8.7 psi (124.9 L/min @ .60 Bar)	A1Y, A2Z	See Footnote 8.
20 ft. x 20 ft. (6.1 m x 6.1 m)	400 ft² (37.2 m²)	40 gpm @ 12.8 psi (151.4 L/min @ .88 Bar)	B1Y, B2Z	See Footnote 8.

Approved Temperature Ratings

A - 135 °F (57 °C), 155 °F (68 °C), and 175 °F (79 °C)
B - 135 °F (57 °C) and 175 °F (79 °C)
C - 155 °F (68 °C)

Approved Finishes

1 - Brass, Chrome, White Polyester, and Black Polyester
2 - ENT[9]

Approved Escutcheons

Y - Standard surface-mounted escutcheons or recessed with the Micromatic® Model E-1, E-2, or E-3 Recessed Escutcheon
Z - Standard surface-mounted escutcheons or the Micromatic Model E-1 Recessed Escutcheon.

Footnotes

[1] The part number shown is the base part number. For the complete part number, refer to the current Viking price list schedule.
[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.
[3] This chart shows listings and approvals available at time of printing; other approvals may be in process. Check with the manufacturer for any additional approvals.
[4] For areas of coverage smaller than those shown, use the "Minimum Water Supply Requirements" for the next larger area listed. Flows and pressures listed are per sprinkler.
[5] cULus Listed for use in the U.S. and Canada for Light Hazard occupancies only.
[6] Listings are limited to Light Hazard Occupancies where allowed by the installation standards being applied.
[7] Accepted for use, City of New York Department of Buildings, MEA 89-92 Vol. 9.
[8] Meets New York City requirements, effective July 1, 2008.
[9] cULus Listed as corrosion-resistant.

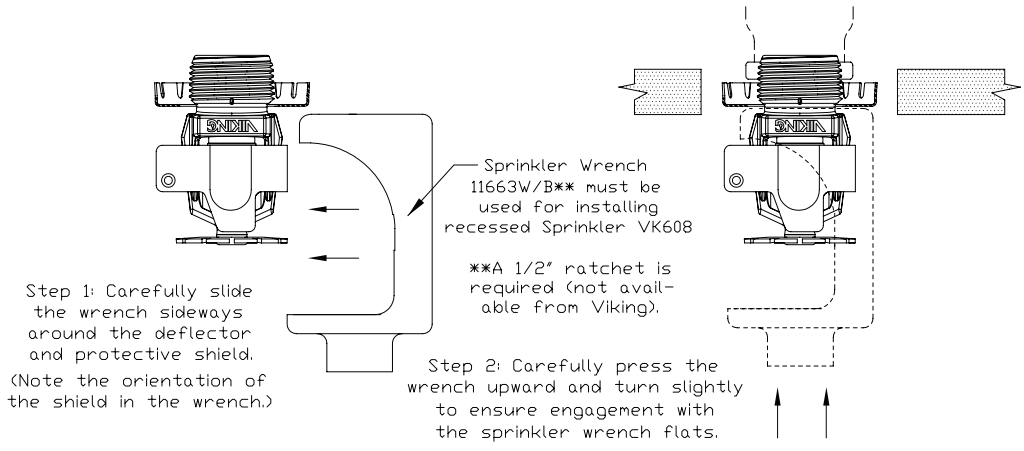

Figure 2: Wrench 11663W/B for Recessed Pendent Sprinkler VK608

TECHNICAL DATA

STANDARD/QUICK RESPONSE EXTENDED COVERAGE LIGHT HAZARD ELO PENDENT SPRINKLER VK608

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
Visit the Viking website for the latest edition of this technical data page www.vikinggroupinc.com.

DESIGN CRITERIA - UL

(Also refer to the Approval Chart on page 3.)

cULus Listing Requirements:

Standard/Quick Response Extended Coverage Light Hazard ELO Pendent Sprinkler VK608 is cULus Listed as indicated in the Approval Chart for installation in accordance with the latest edition of NFPA 13 for extended coverage pendent spray sprinklers. The following requirements must be met:

- Limited to Light Hazard occupancies, where allowed by the installation standards being applied, with smooth, flat, horizontal ceilings only.
- Minimum spacing allowed is 8 ft. (2.4 m) unless baffles are installed in accordance with NFPA 13.
- Minimum distance from walls is 4 in. (102 mm).
- Maximum distance from walls shall be no more than one-half of the allowable distance between sprinklers. The distance shall be measured perpendicular to the wall.
- The sprinkler installation and obstruction rules contained in NFPA 13 for extended coverage pendent spray sprinklers must be followed.

Also, Viking ECLH-ELO Pendent Sprinkler VK608 is specifically cULus Listed:

- For non-combustible obstructed construction within trusses or bar joists having non-combustible web members greater than 1" (25 mm) when applying the 4 times obstruction criteria rule as defined in NFPA 13 under "Obstructions to Sprinkler Discharge Pattern Development".
- For installation under concrete tees when installed as follows:
  1. The stems of the concrete tee construction must be spaced between 3 ft (0.9 m) and 7 ft-6 in (2.3 m) on center. The depth of the concrete tees must not exceed 30 in (762 mm). The maximum permitted concrete tee length is 32 ft (9.8 m). However, where the concrete tee length exceeds 32 ft (9.8 m), non-combustible baffles, equal in height to the depth of the tees, can be installed so that the space between the tees does not exceed 32 ft (9.8 m).
  2. The sprinkler deflector is to be located in a horizontal plane at or above 1" (25 mm) below the bottom of the concrete tee stems.
  3. When the sprinkler deflector is located higher than a horizontal plane 1" (25 mm) beneath the bottom of the concrete tee stems, the obstruction to sprinkler discharge criteria requirements of NFPA 13 for extended coverage upright sprinklers applies.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to pages F_080614 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking Technical Data, the appropriate standards of NFPA, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

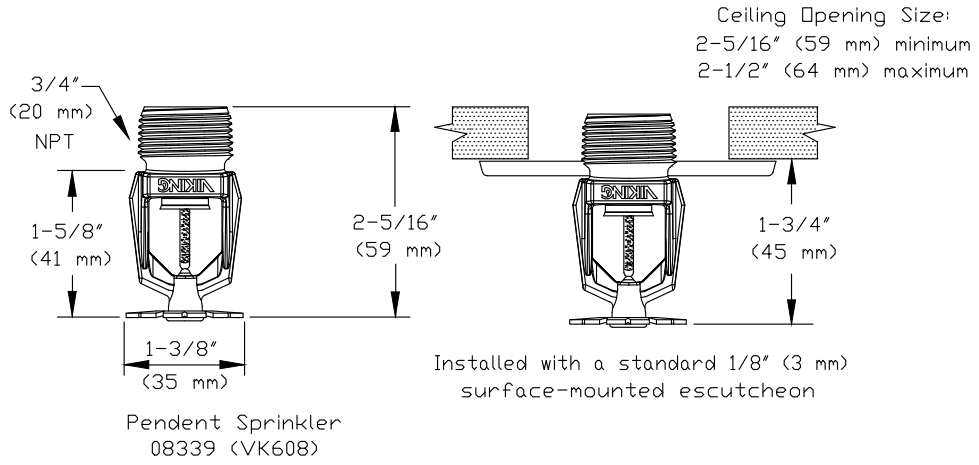

Figure 3: Sprinkler VK608 Dimensions with a Standard Escutcheon

TECHNICAL DATA

STANDARD/QUICK RESPONSE EXTENDED COVERAGE LIGHT HAZARD ELO PENDENT SPRINKLER VK608

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
Visit the Viking website for the latest edition of this technical data page www.vikinggroupinc.com.

Sprinkler Base Part Number[1]	SIN	NPT Thread Size		Nominal K-Factor		Maximum Water Working Pressure	Overall Length	
		Inches	mm	U.S.	metric[2]		Inches	mm
08339	VK608	3/4	20	11.2	161.3	175 psi (12 Bar)	2-5/16	59

KEY
A1X — A: Temperature; 1: Finish; X: Escutcheon (if applicable)

Approval Chart 2 (FM)
Quick Response Extended Coverage ELO Pendent Sprinkler VK608

Maximum Sprinkler Spacing (L x W[4])	Maximum Area per Sprinkler	Minimum Water Supply Requirements[4]	FM Approvals[3] (Refer also to Design Criteria below.)
16 ft. x 16 ft. (4.9 m x 4.9 m)	256 ft² (23.8 m²)	30 gpm @ 7.2 psi (113.6 L/min @ 0.50 Bar)	B1Y, B2Y, A1X, A2X, D2Z, C2X
18 ft. x 18 ft. (5.5 m x 5.5 m)	324 ft² (30.1 m²)	33 gpm @ 8.7 psi (124.9 L/min @ 0.60 Bar)	B1Y, B2Y, A1X, A2X, D2Z, C2X
20 ft. x 20 ft. (6.1 m x 6.1 m)	400 ft² (37.2 m²)	40 gpm @ 12.8 psi (151.4 L/min @ 0.88 Bar)	B1Y, B2Y, A1X, A2X, D2Z, C2X

Approved Temperature Ratings
A - 135 °F (57 °C), 155 °F (68 °C), and 175 °F (79 °C)
B- 135 °F (57 °C), 155 °F (68 °C)
C - 155 °F (68 °C), and 175 °F (79 °C)
D - 155 °F (68 °C)

Approved Finishes
1 - Brass, Chrome, White Polyester, and Black Polyester
2 - ENT[5]

Approved Escutcheons
X - Standard surface-mounted escutcheons
Y - Standard surface-mounted escutcheons or the Microfast® Model F-1 Adjustable Escutcheon, or recessed with the Micromatic® Model E-1, E-2, or E-3 Recessed Escutcheon
Z - Standard surface-mounted escutcheons or the Micromatic Model E-1 Recessed Escutcheon.

Footnotes

[1] Part number shown is the base part number. For complete part number, refer to current Viking price list schedule.

[2] Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

[3] This chart shows the FM Approvals available at time of printing. Other approvals may be in process. Check with the manufacturer for any additional approvals.

[4] For areas of coverage smaller than shown, use the "Minimum Water Supply Requirement" for the next larger area listed. Flows and pressures listed are per sprinkler.

[5] FM Approved as corrosion-resistant.

DESIGN CRITERIA - FM

(Also refer to the Approval Chart above.)

FM Approval Requirements:

Quick Response Extended Coverage Extra-Large Orifice Pendent Sprinkler VK608 is FM Approved as a quick response extended coverage pendent **Non-Storage** sprinkler as indicated in the FM Approval Guide. For specific application and installation requirements, refer to the latest applicable FM Loss Prevention Data Sheets (including 2-0). FM Global Loss Prevention Data Sheets contain guidelines relating to, but not limited to: minimum water supply requirements, hydraulic design, ceiling slope and obstructions, minimum and maximum allowable spacing, and deflector distance below the ceiling.

NOTE: The FM installation guidelines differ from cULus and/or NFPA criteria.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to pages F_080614 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.

TECHNICAL DATA

STANDARD/QUICK RESPONSE EXTENDED COVERAGE LIGHT HAZARD ELO PENDENT SPRINKLER VK608

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
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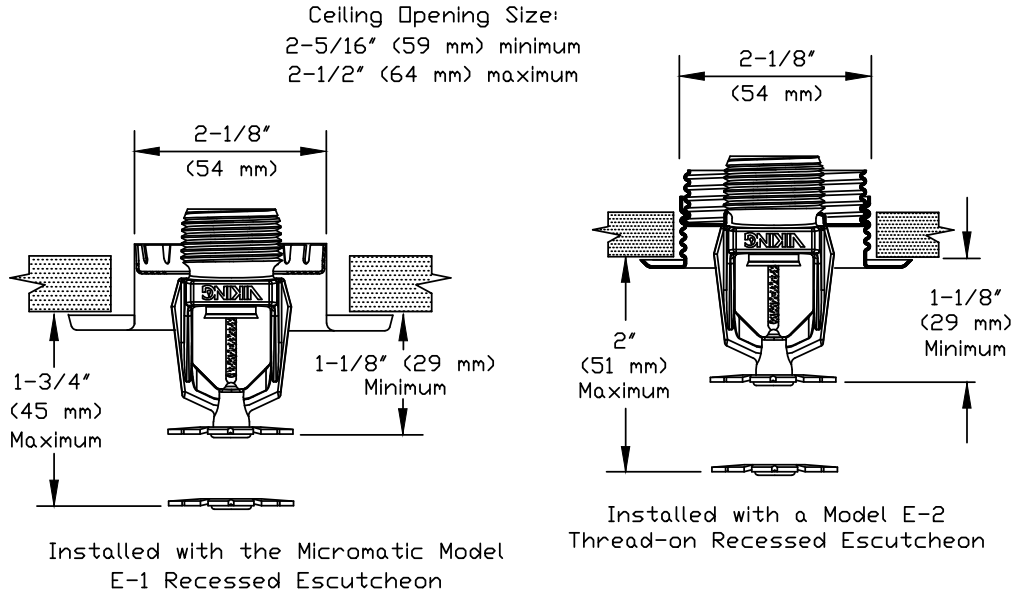

Figure 4: Sprinkler VK608 Dimensions with the Model E-1 and E-2 Recessed Escutcheons

TECHNICAL DATA

SPRINKLER WRENCHES AND CABINETS

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
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1. DESCRIPTION

A. Sprinkler Cabinets

Viking sprinkler cabinets are metal enclosures constructed to store an emergency supply of spare sprinklers and a sprinkler installation wrench.

NFPA 13 requires a representative number of each type and temperature rating of sprinkler head to be kept in a cabinet on the premises. NFPA 13 also requires a special sprinkler wrench to be provided in the cabinet. This allows for immediate removal and replacement of sprinklers that have operated or that have become damaged.

Stock of spare sprinklers should include sprinklers of all the types and temperature ratings as are installed in the sprinkler system, in the following quantities:

Number of Sprinklers in the System	Minimum Number of Spare Sprinklers Required
Under 300	6
300-1,000	12
Over 1,000	24

B. Sprinkler Wrenches

Viking sprinkler wrenches are special installation tools specifically designed for use with the various Viking sprinklers and spray nozzles. The appropriate wrenches must be used with the indicated sprinklers and nozzles to provide the proper leverage when tightening sprinklers or nozzles and to minimize slippage during installation.

Using wrenches other than the ones designated for installation may damage the sprinkler. Refer to Tables 2a and 2b and the appropriate sprinkler or spray nozzle data page for the correct installation wrenches that must be used.

Wrenches 21475M/B, 10896W/B, 07297W/B, 05118CW/B, 13635W/B, and 16888M/B provide the amount of leverage needed to tighten sprinklers and spray nozzles into pipe fittings while preventing sprinkler damage. No additional tools are necessary with these wrenches.

The following wrenches require a separate ½" ratchet (not available from Viking) to provide the correct amount of leverage: 08336W/B, 10366W/B, 07565W/B, 11663W/B, 13032W/B, 13577W/B, 13619, 15466, 13623W/B, 15467W/B, 15209W/R, 13655W/B, 14031, 14047W/B, 16208W/R, and 16267.

The internal diameters of sprinkler wrenches 08336W/B, 10366W/B, 15209W/R, 16208W/R, and 16267 are designed for use with the sprinkler contained in the protective shell. (A protective shell should be retained in the spare sprinkler cabinet.)

Wrench part number 10551W/B is required for threading institutional escutcheon plates onto institutional sprinklers. Wrench part number 10729 is a 2-1/2" (63.5 mm) C-C face spanner wrench used for removing institutional escutcheon plates from institutional sprinklers (refer to the DISASSEMBLY section of institutional sprinkler technical data pages).

Wrench part number 15915 is optional for removing protective sprinkler caps and for installing E-1 and F-1 Escutcheons on frame style pendent sprinklers from the floor by attaching a length of 1" diameter CPVC tubing to the tool. Refer to Technical Bulletin Form No. 051808.

2. LISTINGS AND APPROVALS

Refer to the specific sprinkler or spray nozzle technical data pages for sprinkler listings and approvals.

3. TECHNICAL DATA

Specifications:

Sprinkler Cabinets: Designed with four 3/16" diameter holes in back. Spacing of mounting holes: 3-1/2" (88.9 mm) length, 3-1/2" (88.9 mm) height. The sprinkler cabinet should be located adjacent to the main system riser.

Material Standards:

Sprinkler Cabinets: Cold Rolled Steel. Finish: Painted high-gloss red enamel interior and exterior, chrome plated door knob.
Wrenches: Ductile Iron, Steel, Acetal, or 50% glass filled nylon (for head cabinet wrenches)

Ordering Information: (Also refer to the current Viking price list.)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
Visit the Viking website for the latest edition of this technical data page www.vikinggroupinc.com

A. Sprinkler Cabinets

1. Determine appropriate cabinet from Table 1 on this page for use with the specific model/number of sprinklers to be contained in the cabinet.
2. Specify cabinet part number and quantity needed.

B. Sprinkler Wrenches

1. Determine the appropriate wrench for use with the given sprinkler or spray nozzle model from Tables 2a and 2b.
2. Specify the wrench part number and quantity needed.

NOTE: Sprinklers and sprinkler wrenches are not supplied with the cabinets; they must be ordered separately.

4. INSTALLATION

Refer to the appropriate sprinkler or spray nozzle technical data page.

5. OPERATION

Refer to the sprinkler or spray nozzle techical data page for the particular model used.

6. INSPECTIONS, TESTS AND MAINTENANCE

Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

7. AVAILABILITY

The Viking sprinkler wrenches and cabinets are available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

8. GUARANTEE

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

For Sprinkler Models:	Cabinet Capacity	Cabinet Part No.	Size		
			Length	Height	Depth
Viking frame style sprinklers	6 sprinklers	01724A Available since 1971.	10-3/16" (259 mm)	4-11/16" (103 mm)	2-9/16" (65 mm)
Viking frame style sprinklers, ESFR K14 sprinklers, K16.8 pendent sprinklers, and K25.2 EC sprinklers	12 sprinklers (6 K25.2 EC sprinklers)	01725A Available since 1971.	10-3/16" (259 mm)	8-9/16" (217 mm)	2-9/16 (65 mm)
Viking concealed and flush style sprinklers, ESFR K25.2 and K22.4 pendent sprinklers, and K19.6 CMSA sprinklers	5-6 sprinklers	01731A Available since 1971.	13-13/16" (351 mm)	5-11/16" (144 mm)	3" (76 mm)
High Challenge® Sprinklers, upright ESFR sprinklers, and Intermediate Level Sprinklers	6 sprinklers	03985A Available since 1977	12-5/8" (321 mm)	9-1/8" (232 mm)	4-1/8" (105 mm)

Table 1: Sprinkler Cabinets

TECHNICAL DATA

SPRINKLER WRENCHES AND CABINETS

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
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IMPORTANT NOTES

The sprinkler cabinet should be easily accessible.

The sprinkler cabinet must not be exposed to corrosive atmospheres or temperatures above 100 °F (38 °C).

The stock of spare sprinklers should include an adequate number of sprinklers of each type and temperature rating.

The stock of sprinklers must be in good condition.

A sprinkler wrench of the appropriate type must be included in the cabinet.

Orient sprinklers and sprinkler wrench as indicated in Figure 1 below.

CAUTION: When replacing automatic sprinklers in an existing system, be sure to replace with sprinklers of the correct type, thread size, orifice size, temperature rating, and finish.

IMPORTANT: Always refer to Bulletin Form No. F_091699 - Care and Handling of Sprinklers. Also refer to the appropriate sprinkler data page. Viking sprinklers and spray nozzles are designed to be installed in accordance with the latest edition of Viking technical data, the latest standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards whenever applicable. The use of certain types of sprinklers may be limited due to occupancy and hazard. Refer to the Authority Having Jurisdiction prior to installation.

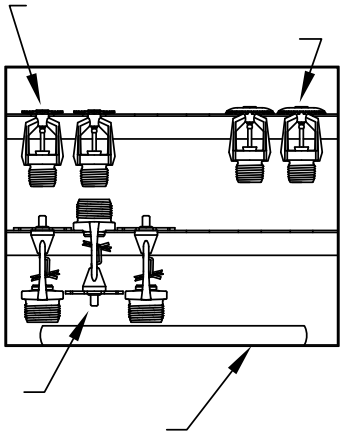

Figure 1: Correct orientation of sprinklers and wrench inside cabinet. (12-head cabinet shown)

Figure 2: Sprinkler Cabinet 01724A (Sprinklers and wrench not included)

Figure 3: Sprinkler Cabinet 01725A (Sprinklers and wrench not included)

TECHNICAL DATA

SPRINKLER WRENCHES AND CABINETS

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For Sprinkler Models:	Use Wrench:
Frame-style sprinklers and spray nozzles	21475M/B Available since 2017
Wax coated Frame-style sprinklers and spray nozzles	10896W/B Available since 2000 or 05000CW/B*
Wax coated sprinklers and domed concealed pendent sprinklers	13577W/B Available since 2006 replaces 07398W*
Recessed horizontal sidewall sprinklers with protective shields, domed concealed horizontal sidewall sprinklers, and recessed pendent sprinklers	13655W/B Available since 2006
Coated and recessed ECOH K14 sprinkler	13032W/B Available since 2004
Standard adjustable and plain barrel dry sprinklers, K16.8 and ECOH K14 sprinklers	07297W/B Available since 1991
Recessed and domed concealed dry sprinklers	07565W/B Available since 1991
High Challenge® sprinklers, upright ESFR sprinklers, and ELO sprinklers**	05118CW/B Available since 1981
Coated, recessed, and domed concealed ELO sprinklers	11663W/B Available since 2001
Pendent K14 and K16.8 ESFR sprinklers	13635W/B double ended (use Side A) Available since 2006, or 10285W/B*
Pendent K25.2, K22.4 ESFR sprinklers and K19.6 CMSA Sprinkler VK592	13635W/B double ended (use Side B) Available since 2006, or 12143W/B*
Upright EC K25.2 sprinklers	16888M/B Available since 2011
QR and EC Concealed Sprinklers VK461, VK462, VK463, VK464, VK465, VK632, and VK634 (also optional for cap removal)	14031† Available since 2006
QR and EC Concealed Sprinklers VK461, VK462, VK463, VK464, VK465, VK632, and VK634	14047W/B (heavy duty) Available since 2006
Residential Concealed Sprinklers VK456, VK457, VK474, and VK488 (also optional for removal of protective caps)	13619† (red) Available since 2006

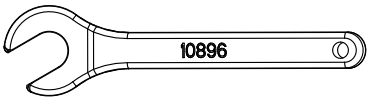
*Wrench no longer available. May still be used until wrench replacement is necessary.

**ELO sprinklers manufactured before Dec. 2001 use wrench part number 07297W/B (07565W/B for coated and recessed).

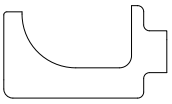
†Ideal for sprinkler cabinets.

Table 2a: Sprinkler Wrenches

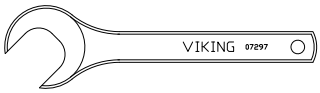
Part No. 21475M/B



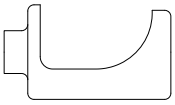
Part No. 10896W/B



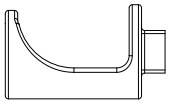
Part No. 13577W/B & 13032W/B



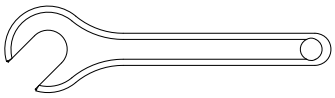
Part No. 07297W/B



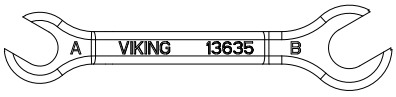
Part Nos. 07565W/B & 11663W/B



Part No. 13655W/B

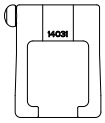


Part No. 05118CW/B

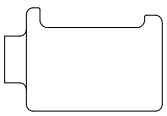


Part No. 13635W/B

Part No. 16888M/B



Part No. 14031



Part No. 14047W/B

Figure 4a: Sprinkler Wrenches

TECHNICAL DATA

SPRINKLER WRENCHES AND CABINETS

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
Visit the Viking website for the latest edition of this technical data page www.vikinggroupinc.com

For Sprinkler Models:	Use Wrench:
Residential Concealed Sprinklers VK456, VK457, VK474, and VK488	13623W/B (heavy duty) Available since 2006
Residential Concealed HSW Sprinkler VK480	16267† or 16208W/R (heavy duty) Available since 2010
Mirage® QR ELO Concealed Sprinklers VK636 and VK469 (also optional for removal of protective caps)	15466† Available since 2009
Mirage® QR ELO Concealed Sprinklers VK636 and VK469	15467W/B (heavy duty) Available since 2009
Mirage® Concealed and flush style sprinklers	08336W/B (heavy duty) Available since 1993
Mirage® Concealed and flush style sprinklers	10366W/B† Available since 1998
Residential Flush Pendent Sprinklers VK476 and VK478	15209W/R (heavy duty) Available since 2009
Recessed Flush Dry Sprinklers VK482	18315 (heavy duty) Available since 2014
Mirage® and Freedom® Concealed Sprinklers VK461, VK462, VK463, VK464, VK465, VK469, VK474, VK632, VK634, VK636, and VK488 (optional concealed cover installer tool)	14412†, or 14867 for the large diameter cover, Available since 2007
Shipping Cap Remover/ Escutcheon Installer (optional***)	15915† Available since 2010
Institutional style flush sprinklers (for installation of the escutcheon plate)	10551W/B Available since 1999
Institutional style flush sprinklers (spanner wrench for escutcheon plate removal)	10729 Available since 1999

***Allows removal of sprinkler caps and installation of E-1 and F-1 escutcheons on frame style pendent sprinklers from the floor.
†Ideal for sprinkler cabinets.

Table 2b: Sprinkler Wrenches

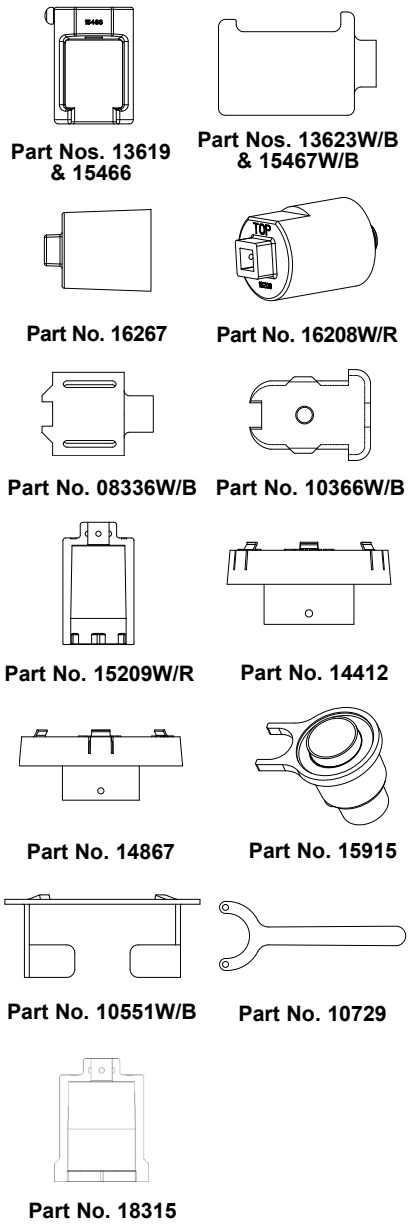


Figure 4b: Sprinkler Wrenches

POTTER
The Symbol of Protection

BELLS
PBA-AC & MBA-DC

UL, ULC, and FM Approved
Sizes Available: 6" (150mm), 8" (200mm) and 10" (250mm)
Voltages Available: 24VAC
120VAC
12VDC (10.2 to 15.6) Polarized
24VDC (20.4 to 31.2) Polarized
Service Use: Fire Alarm
General Signaling
Burglar Alarm
Environment: Indoor or outdoor use (See Note 1)
-40° to 150°F (-40° to 66°C)
(Outdoor use requires weatherproof backbox.)
Termination: AC Bells - 4 No. 18 AWG stranded wires
DC Bells - Terminal strip
Finish: Red powder coating
Optional: Model BBK-1 weatherproof backbox
Model BBX-1 deep weatherproof backbox

These vibrating type bells are designed for use as fire, burglar or general signaling devices. They have low power consumption and high decibel ratings. The unit mounts on a standard 4" (101mm) square electrical box for indoor use or on a model BBK-1 weatherproof backbox or BBX-1 deep weatherproof backbox for outdoor applications. Weatherproof backbox model BBK-1, Stock No. 1500001.

Notes:
1. Minimum dB ratings are calculated from integrated sound pressure measurements made at Underwriters Laboratories as specified in UL Standard 464. UL temperature range is -30° to 150°F (-34° to 66°C).
2. Typical dB ratings are calculated from measurements made with a conventional sound level meter and are indicative of output levels in an actual installation.
3. ULC only applies to MBA DC bells.

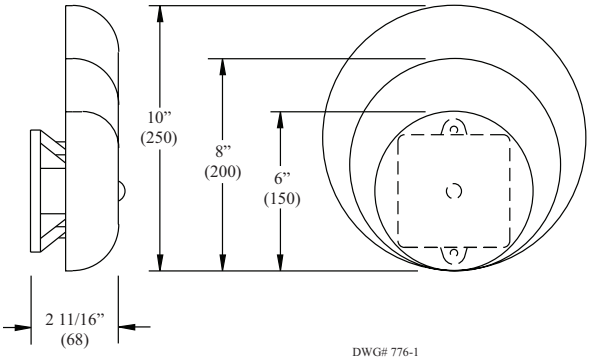
Size inches (mm)	Voltage	Model Number	Stock Number	Current (Max.)	Typical dB at 10 ft. (3m) (2)	Minimum dB at 10 ft. (3m) (1)
6 (150)	12VDC	MBA-6-12	1750070	.12A	85	76
8 (200)	12VDC	MBA-8-12	1750080	.12A	90	77
10 (250)	12VDC	MBA-10-12	1750060	.12A	92	78
6 (150)	24VDC	MBA-6-24	1750100	.06A	87	77
8 (200)	24VDC	MBA-8-24	1750110	.06A	91	79
10 (250)	24VDC	MBA-10-24	1750090	.06A	94	80
6 (150)	24VAC	PBA246	1806024*	.17A	91	78
8 (200)	24VAC	PBA248	1808024*	.17A	94	77
10 (250)	24VAC	PBA2410	1810024*	.17A	94	78
6 (150)	120VAC	PBA1206	1806120*	.05A	92	83
8 (200)	120VAC	PBA1208	1808120*	.05A	99	84
10 (250)	120VAC	PBA12010	1810120*	.05A	99	86

All DC bells are polarized and have built-in transient protection.
* Does not have ULC listing.

⚠ WARNING

In outdoor or wet installations, bell must be mounted with weatherproof backbox, BBK-1 or BBX-1. Standard electrical boxes will not provide a weatherproof enclosure. If the bell and/or assembly is exposed to moisture, it may fail or create an electrical hazard.

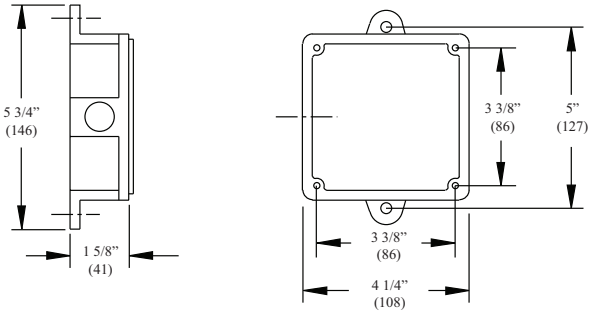
Bells Dimensions Inches (mm)
Fig. 1



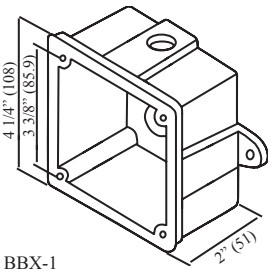
DWG# 776-1

Weatherproof Backbox Dimensions Inches (mm)
Fig. 2

Box has one threaded 1/2" conduit entrance

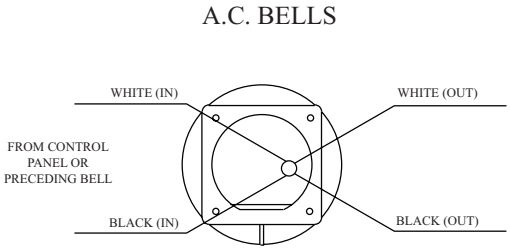


DWG# 776-2



BBX-1

Wiring (rear view)
Fig. 3

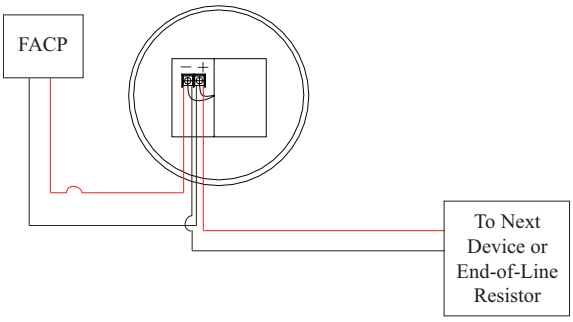


CAUTION:
WHEN ELECTRICAL SUPERVISION IS REQUIRED USE IN AND OUT LEADS AS SHOWN.

NOTES:

1. WHEN USING AC BELLS, TERMINATE EACH EXTRA WIRE SEPARATELY AFTER LAST BELL.
2. END-OF-LINE RESISTOR IS NOT REQUIRED ON AC BELLS.

DWG# 776-3



Installation

1. The bell shall be installed in accordance with NFPA 13, 72, or local AHJ. The top of the device shall be no less than 90" AFF and not less than 6" below the ceiling.
2. Remove the gong.
3. Connect wiring (see Fig. 3).
4. Mount bell mechanism to backbox (bell mechanism must be mounted with the striker pointing down).
5. Reinstall the gong (be sure that the gong positioning pin, in the mechanism housing, is in the hole in the gong).
6. Test all bells for proper operation and observe that they can be heard where required (bells must be heard in all areas as designated by the authority having jurisdiction).

⚠ WARNING

Failure to install striker down will prevent bell from operating.

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING - BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No. 7135-0328:0119

CATEGORY: 7135 -- AUDIBLE DEVICES

LISTEE: Potter Electric Signal Co1609 Park 370 Place, Hazelwood, 63042 United States
Contact: Bill Witherspoon (314) 595-6900 Fax (314) 595-6999
Email: BillW@pottersignal.com

DESIGN: Models SB624-153075, SB624-75110, PBA246, PBA248, PBA2410, PBA1206, PBA1208, PBA12010, *PBD-126, *PBD-128, *PBD-1210, *PBD-246, *PBD-248, * PBD-2410 vibrating bells. Suitable for outdoor use when used with Model BBK-1 backbox. Models are AC or DC powered and available in 6", 8" and 10". Models MBA-6, -8 and -10 bells, suitable for outdoor use when used with Model BBX-1 backbox. Refer to listee's data sheet for detailed product description and operational considerations.

RATING:
PBA-246, -248, -2410: 24 VAC
PBA-1206, -1208, -12010: 120 VAC
MBA-6, -8, -10: 12 or 24 VDC
*PBD-126, -128, -1210: 12VDC, .12A
*PBD-246, -248, -2410: 24VDC, .06A

INSTALLATION: In accordance with listee's printed installation instruction, applicable codes & ordinances, and in a manner acceptable to the authority having jurisdiction.

MARKING: Listee's name, model number and UL label.

APPROVAL: Listed as audible devices for use with separately listed compatible fire alarm control units. If this appliance is required to produce a distinctive three-pulse Temporal Pattern Fire Alarm Evacuation Signal (for total evacuation) in accordance with NFPA 72, 2002 Edition, the appliance must be used with a fire alarm control unit that can generate the temporal pattern signal. Refer to manufacturer’s Installation Manual for details.

*Revision 01-31-2017 dcc

Date Issued: **July 01, 2019** *Listing Expires* **June 30, 2020**

Authorized By: ***DAVID CASTILLO**, Program Coordinator*

Fire Engineering Division

VSR
VANE TYPE WATERFLOW ALARM SWITCH WITH RETARD

UL, CUL and CSFM Listed, FM Approved, LPCB Approved, For CE Marked (EN12259-5) / VdS Approved model use VSR-EU

Service Pressure: 450 PSI (31 BAR) - UL

Flow Sensitivity Range for Signal:
4-10 GPM (15-38 LPM) - UL

Maximum Surge: 18 FPS (5.5 m/s)

Contact Ratings: Two sets of SPDT (Form C)
10.0 Amps at 125/250VAC
2.0 Amps at 30VDC Resistive
10 mAmps min. at 24VDC

Conduit Entrances: Two knockouts provided for 1/2" conduit. Individual switch compartments suitable for dissimilar voltages.

Environmental Specifications:

- NEMA 4/IP54 Rated Enclosure suitable for indoor or outdoor use with factory installed gasket and die-cast housing when used with appropriate conduit fitting.
- Temperature Range: 40°F - 120°F, (4.5°C - 49°C) - UL
- Non-corrosive sleeve factory installed in saddle.

Service Use:

Automatic Sprinkler	NFPA-13
One or two family dwelling	NFPA-13D
Residential occupancy up to four stories	NFPA-13R
National Fire Alarm Code	NFPA-72

Specifications subject to change without notice.

Ordering Information			
Nominal Pipe Size		Model	Part Number
2"	DN50	VSR-2	1144402
2 1/2"	DN65	VSR-2 1/2	1144425
3"	DN80	VSR-3	1144403
3 1/2"	-	VSR-3 1/2	1144435
4"	DN100	VSR-4	1144404
5"	-	VSR-5	1144405
6"	DN150	VSR-6	1144406
8"	DN200	VSR-8	1144408

Optional: Cover Tamper Switch Kit, stock no. 0090148
Replaceable Components: Retard/Switch Assembly, stock no. 1029030

⚠ WARNING

- Installation must be performed by qualified personnel and in accordance with all national and local codes and ordinances.
- Shock hazard. Disconnect power source before servicing. Serious injury or death could result.
- Risk of explosion. Not for use in hazardous locations. Serious injury or death could result.

CAUTION

Waterflow switches that are monitoring wet pipe sprinkler systems shall not be used as the sole initiating device to discharge AFFF, deluge, or chemical suppression systems. Waterflow switches used for this application may result in unintended discharges caused by surges, trapped air, or short retard times.

General Information

The Model VSR is a vane type waterflow switch for use on wet sprinkler systems. It is UL Listed and FM Approved for use on steel pipe; schedules 10 through 40, sizes 2" thru 8" (50 mm thru 200 mm). LPC approved sizes are 2" thru 8" (50 mm thru 200 mm). See Ordering Information chart.

The VSR may also be used as a sectional waterflow detector on large systems. The VSR contains two single pole, double throw, snap action switches and an adjustable, instantly recycling pneumatic retard. The switches are actuated when a flow of 10 GPM (38 LPM) or more occurs downstream of the device. The flow condition must exist for a period of time necessary to overcome the selected retard period.

Enclosure

The VSR switches and retard device are enclosed in a general purpose, die-cast housing. The cover is held in place with two tamper resistant screws which require a special key for removal. A field installable cover tamper switch is available as an option which may be used to indicate unauthorized removal of the cover. See bulletin number 5401103 for installation instructions of this switch.

VSR
VANE TYPE WATERFLOW ALARM SWITCH WITH RETARD

Installation (see Fig. 1)

These devices may be mounted on horizontal or vertical pipe. On horizontal pipe they shall be installed on the top side of the pipe where they will be accessible. The device should not be installed within 6" (15 cm) of a fitting which changes the direction of the waterflow or within 24" (60 cm) of a valve or drain.

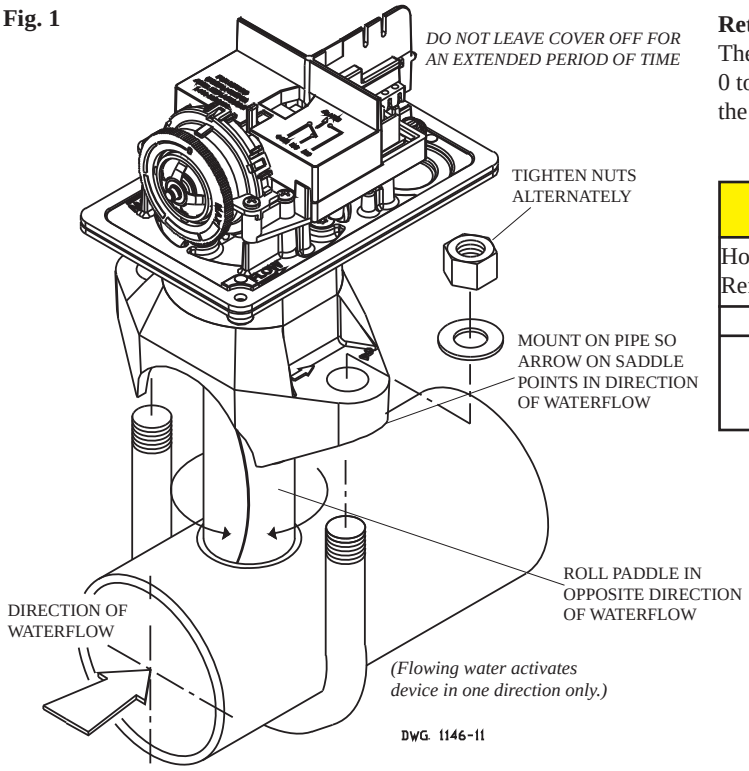
NOTE: Do not leave cover off for an extended period of time.

Drain the system and drill a hole in the pipe using a hole saw in a slow speed drill (see Fig. 1). Clean the inside pipe of all growth or other material for a distance equal to the pipe diameter on either side of the hole. Roll the vane so that it may be inserted into the hole; do not bend or crease it. Insert the vane so that the arrow on the saddle points in the direction of the waterflow. Take care not to damage the non-corrosive bushing in the saddle. The bushing should fit inside the hole in the pipe. Install the saddle strap and tighten nuts alternately to required torque (see the chart in Fig. 1). The vane must not rub the inside of the pipe or bind in any way.

⚠ CAUTION

Do not trim the paddle. Failure to follow these instructions may prevent the device from operating and will void the warranty.

Fig. 1

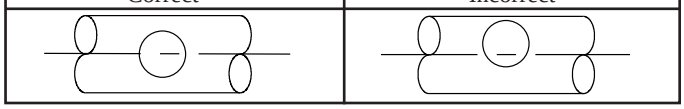


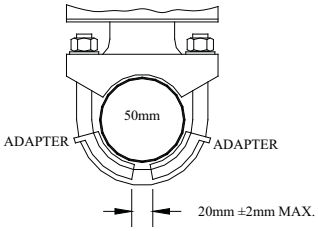
Retard Adjustment

The delay can be adjusted by rotating the retard adjustment knob from 0 to the max setting (60-90 seconds). The time delay should be set at the minimum required to prevent false alarms

CAUTION

Hole must be drilled perpendicular to the pipe and vertically centered. Refer to the Compatible Pipe/Installation Requirements chart for size.





DN50 ONLY

USE (2) 5180162 ADAPTERS AS SHOWN ABOVE

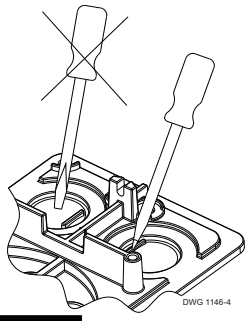
DWG# 1146-1F

Compatible Pipe/ Installation Requirements

Model	Nominal Pipe Size		Nominal Pipe O.D.		Pipe Wall Thickness								Hole Size		U-Bolt Nuts Torque	
					Schedule 10 (UL)		Schedule 40 (UL)		BS-1387 (LPC)		DN (VDS)					
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	ft-lb	n-m
VSR-2	2	DN50	2.375	60.3	0.109	2.77	0.154	3.91	0.142	3.6	0.091	2.3	1.25 + .125/-.062	33.0 ± 2.0	20	27
VSR-2 1/2	2.5	-	2.875	73.0	0.120	3.05	0.203	5.16	-	-	-	-				
VSR-2 1/2	-	DN65	3.000	76.1	-	-	-	-	0.142	3.6	0.102	2.6				
VSR-3	3	DN80	3.500	88.9	0.120	3.05	0.216	5.49	0.157	4.0	0.114	2.9	2.00 ± .125	50.8 ± 2.0		
VSR-3 1/2	3.5	-	4.000	101.6	0.120	3.05	0.226	5.74	-	-	-	-				
VSR-4	4	DN100	4.500	114.3	0.120	3.05	0.237	6.02	0.177	4.5	0.126	3.2				
VSR-5	5	-	5.563	141.3	0.134	3.40	0.258	6.55	-	-	-	-				
VSR-6	6	DN150	6.625	168.3	0.134	3.40	0.280	7.11	0.197	5.0	0.157	4.0				
VSR-8	8	DN200	8.625	219.1	0.148	3.76	0.322	8.18	0.248	6.3	0.177	4.5				

NOTE: For copper or plastic pipe use Model VSR-CF.

Fig. 2
To remove knockouts: Place screwdriver at inside edge of knockouts, not in the center.



NOTICE
Do not drill into the base as this creates metal shavings which can create electrical hazards and damage the device. Drilling voids the warranty.

Fig. 3
Break out thin section of cover when wiring both switches from one conduit entrance.

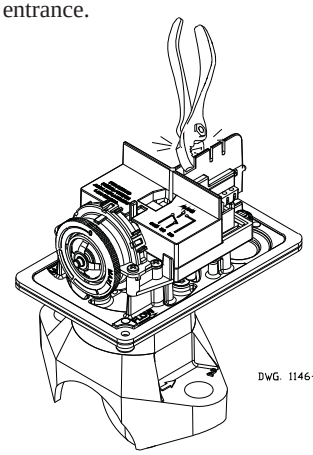
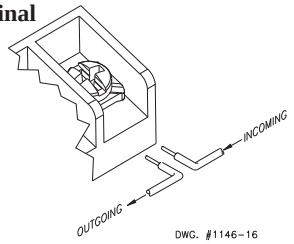


Fig. 4 Switch Terminal Connections Clamping Plate Terminal

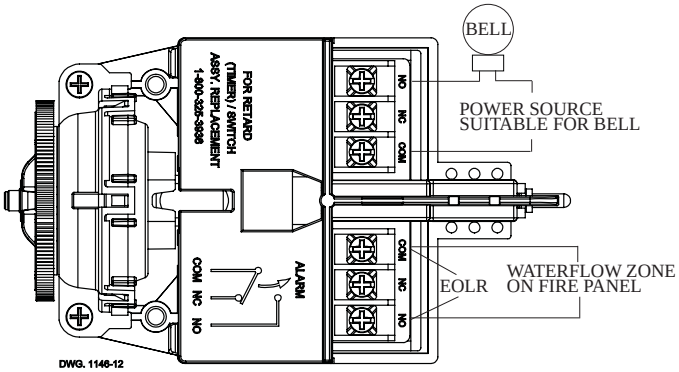


WARNING
An uninsulated section of a single conductor should not be looped around the terminal and serve as two separate connections. The wire must be severed, thereby providing supervision of the connection in the event that the wire become dislodged from under the terminal. Failure to sever the wire may render the device inoperable risking severe property damage and loss of life.

Do not strip wire beyond 3/8" of length or expose an uninsulated conductor beyond the edge of the terminal block. When using stranded wire, capture all strands under the clamping plate.

Fig. 5 Typical Electrical Connections

Notes:
1. The Model VSR has two switches, one can be used to operate a central station, proprietary or remote signaling unit, while the other contact is used to operate a local audible or visual annunciator.
2. A condition of LPC Approval of this product is that the electrical entry must be sealed to exclude moisture.
3. For supervised circuits, see "Switch Terminal Connections" drawing and warning note (Fig. 4).

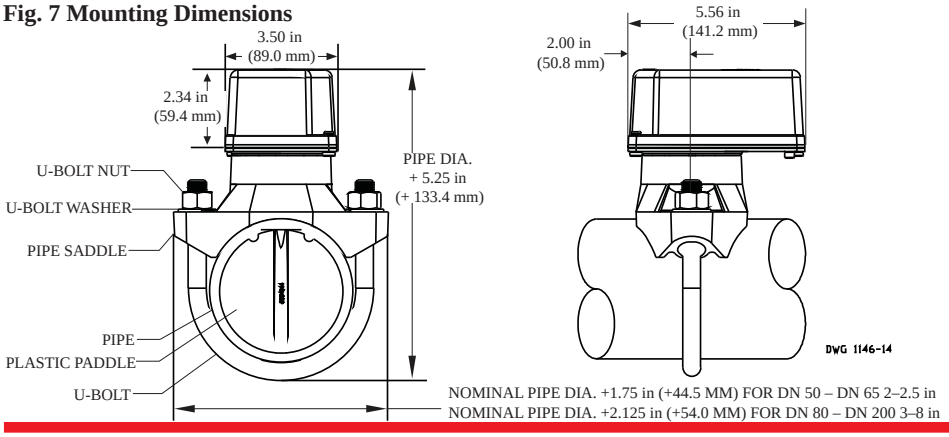


Testing
The frequency of inspection and testing for the Model VSR and its associated protective monitoring system shall be in accordance with applicable NFPA Codes and Standards and/or the authority having jurisdiction (manufacturer recommends quarterly or more frequently).

If provided, the inspector's test valve shall always be used for test purposes. If there are no provisions for testing the operation of the flow detection device on the system, application of the VSR is not recommended or advisable.
A minimum flow of 10 GPM (38 LPM) is required to activate this device.

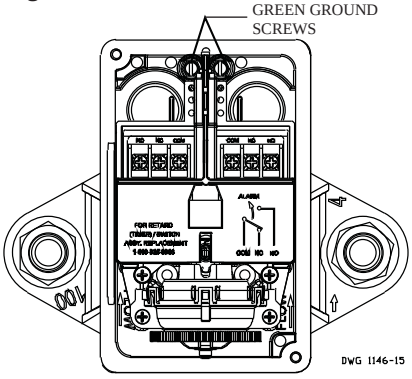
NOTICE Advise the person responsible for testing of the fire protection system that this system must be tested in accordance with the testing instructions.

Fig. 7 Mounting Dimensions



NOMINAL PIPE DIA. +1.75 in (+44.5 MM) FOR DN 50 – DN 65 2–2.5 in
NOMINAL PIPE DIA. +2.125 in (+54.0 MM) FOR DN 80 – DN 200 3–8 in

Fig. 8



CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING - BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No. 7770-0328:0001

CATEGORY: 7770 -- VALVES/SWITCHES

LISTEE: Potter Electric Signal Co1609 Park 370 Place, Hazelwood, 63042 United States
Contact: Bill Witherspoon (314) 595-6900 Fax (314) 595-6999
Email: BillW@pottersignal.com

DESIGN: Vane and pressure type water flow alarm switches listed below. Refer to listee's data sheet for detailed product description and operational considerations.

Vane Types:

VSR-CF	VSR-D	VSR-F	VSR-SF
VSR-FE-2	VS-SP	VS-F	VSR-SFG
VSR-SFT	VSG	VSR	VSR-S
VSR-C	VSR-ST	VSR-SG	

Pressure Type:

WFS-B	WFSR-C	WFSPD-B	PS10
PS-10A	PS-100A	WFSR-F	PS100

INSTALLATION: In accordance with listee's printed installation instructions, applicable codes and ordinances and in a manner acceptable to the authority having jurisdiction.

MARKING: Listee's name, model number and UL or FM label.

APPROVAL: Listed as waterflow alarm switches for use with fire sprinkler systems. Vane models may be used in wet pipe systems; pressure models may be used in wet or dry systems. Model VSR-CF is for use on K, L or M copper pipe (2", 2-1/2", 3", 4") and listed CPVC pipe (2", 2-1/2", 3"). Model VSR-SF for use on 1", 1-1/4", 1-1/2" and *2" steel, copper or listed plastic pipe. Model VSG is for low flow rate. Model VSR-SFG and VSR-SFT are for use on 1", 1-1/4", 1-1/2" and *2" plastic pipe. Models VS-F, VSR-F, VSR-FE and VSR-FE-2 is for use on 2", 2-1/2", 3", 3-1/2", 4", 5", 6", 8" and 10" pipe. *Model VSR is for use on steel pipe sizes from 2" through 8". Vane type switches may be used outdoors when the outdoor temperature never falls below 40oF.

Rev*5-17-2007 jw

Date Issued: **July 01, 2019** *Listing Expires* **June 30, 2020**

Authorized By: ***DAVID CASTILLO**, Program Coordinator*

Fire Engineering Division

Fig. 92 (Formerly Afcon Fig. 100) Universal C-type Clamp (Standard Throat)

Size Range: 3/8" and 1/2"
Material: Ductile iron, hardened steel cup point set screw and locknut.
Finish: ☐ Plain or ☐ Zinc Plated (Hot-Dip Galvanized optional)
Service: Recommended for use under roof installations with bar joist type construction, or for attachment to the top or bottom flange of structural shapes where the vertical hanger rod is required to be offset from the edge of the flange and where the thickness of joist or flange does not exceed 3/4".
Approvals: Complies with Federal Specification A-A-1192A (Type 19 & 23) *WW-H-171-E (Type 23)*, ANSI/MSS SP-69 and MSS SP-58 (Type 19 & 23). UL, ULC Listed and FM Approved.
How to size: Size of clamp is determined by size of rod to be used.
Installation: Follow recommended set screw torque values per MSS-SP-69.
Features:

- They may be attached to horizontal flanges of structural members in either the top beam or bottom beam positions.
- Secured in place by a cup-pointed Set Screw tightened against the flange. A Jam Nut is provided for tightening the Set Screw against the Body Casting.
- Thru tapping of the body casting permits extended adjustment of the threaded rod.
- Can be used with Fig 89X retaining clip for seismic applications.

Ordering: Specify rod size, figure number, name of clamp and finish.

c UL us LISTED FM APPROVED

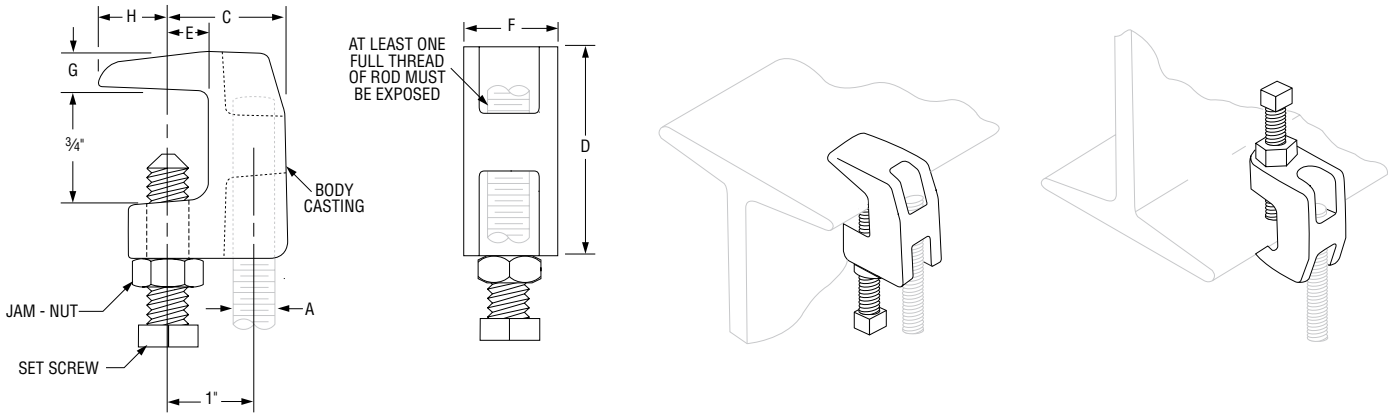


FIG. 92: DIMENSIONS (IN) • LOAD (LBS) • TORQUE (IN-LBS) • WEIGHT (LBS)											
Rod Size A	Set Screw Size	Torque Value	Max Loads ■		Weight	C	D	E	F	G	H
			Top	Bottom							
3/8	3/8	60	500	250	0.34	1 5/16	1 9/16	9/16	1 3/16	3/8	1/2
1/2	1/2	125	950	760	0.63	1 3/8	1 13/16	1/2	1 1/16	7/16	23/32

■ Maximum temperature of 450° F

PROJECT INFORMATION	APPROVAL STAMP
Project:	☐ Approved
Address:	☐ Approved as noted
Contractor:	☐ Not approved
Engineer:	**Remarks:**
Submittal Date:	
Notes 1:	
Notes 2:	

Fig. 610 (Formerly Afcon Fig. 610) Ceiling Plate

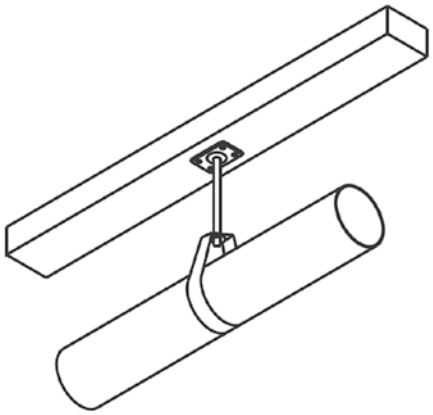
Size Range: 3/8" rod
Material: Carbon Steel
Finish: Electro-Galvanized per ASTM B633
Service: Ceiling plate mounts on the underside of wood and steel to support up to 4" NPS horizontal piping.
Approvals: cULus Listed (UL 203)
Installation:

- Mount on the underside of wood or steel using the fasteners listed in NFPA 13 and the mounting fastener table listed below.
- Fully thread the rod through the threaded mounting hole.

Features:

- Fastener array optimizes the fastener size and placement for various structure types and pipe sizes.

Ordering: Specify figure number, finish, and description.



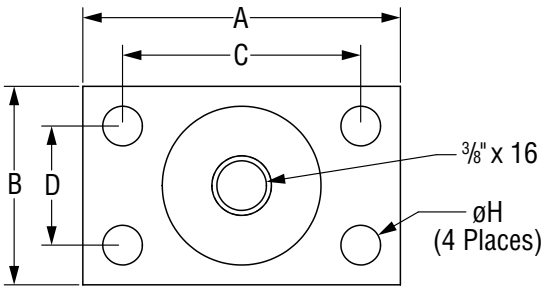
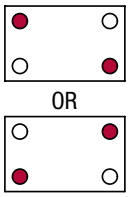
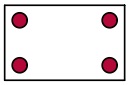


FIG. 610: WEIGHT (LBS) • DIMENSION (IN)						
Rod Size	A	B	C	D	øH	Approx. Weight/100
3/8	2	1¼	1½	¾	¼	20

cULus LISTED MOUNTING FASTENERS POSITIONS

QTY of 2 Fasteners	QTY of 4 Fasteners
	

cULus LISTED MOUNTING FASTENERS FOR STEEL PIPE

Structure	Fastener Options	QTY	Pipe Size
Wood	¼" x 1½" Lag Screw #14 x 1½" TEK Screw	2	≤ 3"
Wood	¼" x 1½" Lag Screw #14 x 1½" TEK Screw	4	≤ 4"
Steel (14ga Min)	¼" x 1" TEK Screw #14 x 1" TEK Screw	2	≤ 4"
Steel (16ga Min)	¼" x 1" TEK Screw #14 x 1" TEK Screw	2	≤ 2"
Steel (16ga Min)	¼" x 1" TEK Screw #14 x 1" TEK Screw	4	≤ 4"
Steel (18ga Min)	#10 x 1" TEK Screw	4	≤ 2½"
Steel (20ga Min)	#10 x 1" TEK Screw	4	≤ 2½"
Steel (22ga Min)	#10 x 1" TEK Screw	4	≤ 2"

Note: Sheet Metal Screws are acceptable alternatives for TEK Screws. If installing through gypsum board or sheetrock into wood, the fastener length must be increased. A minimum of 1 3/8" screw embedment in the wood is required.

PROJECT INFORMATION	APPROVAL STAMP
Project:	❑ Approved
Address:	❑ Approved as noted
Contractor:	❑ Not approved
Engineer:	**Remarks:**
Submittal Date:	
Notes 1:	
Notes 2:	

Fig. 69 (Formerly Afcon Fig. 300) Adjustable Swivel Ring, Tapped Per NFPA Standards

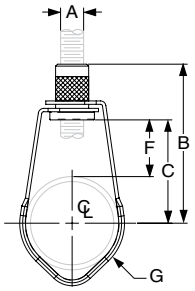
Size Range: 1/2" through 8"
Material: Carbon steel
Finish: Strap is Pre-Galvanized Zinc Material. Nut is Zinc Plated.
Service: Recommended for suspension of non-insulated **stationary** pipe line.
Maximum Temperature: 450° F
Approvals: Complies with Federal Specification A-A-1192A (Type 10), *WW-H-171-E (Type 10)*, and ANSI/MSS SP-58 (Type 10). UL Listed and FM Approved (Sizes 3/4" - 8").
Features:

- 1/2" - 2" sizes designed for use with steel and CPVC piping and manufactured with FBC System Compatible oil.
- Threads are countersunk so that they cannot become burred or damaged.
- Knurled swivel nut provides vertical adjustment after piping is in place.
- Captured swivel nut in the 1/2" through 6" sizes. The capture is permanent in the bottom portion of the band, allowing the hanger to be opened during installation if desired, but not allowing the nut to fall completely out.

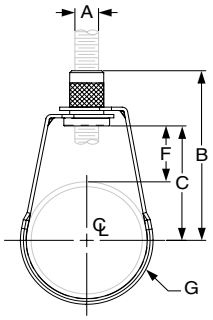
Ordering: Specify size, figure number and name.
Non-captured nut also available upon request.

1/2" through 2" Size
Rounded Edge Design

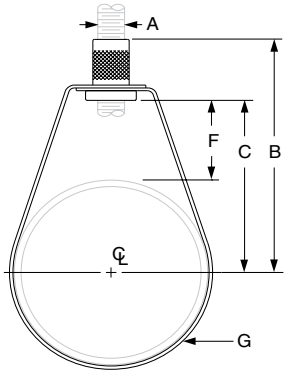
c UL us LISTED FM APPROVED



1/2" through 1" pipe



1 1/4" through 2" pipe



2 1/2" through 8" pipe

2 1/2" through 8" Size

FIG. 69: DIMENSIONS (IN) • LOADS (LBS) • WEIGHT (LBS)

Pipe Size	Max Load	Weight	Rod Size A	B	C	F	G Width
1/2	300	0.10	3/8	2 7/8	2	1 9/16	5/8
3/4		0.10		2 3/4	1 7/8	1 5/16	
1		0.10		2 9/16	1 11/16	1	
1 1/4		0.10		2 5/8	1 3/4	7/8	
1 1/2		0.10		2 3/4	1 7/8		
2		0.11		3 1/4	2 3/8	1 1/8	
2 1/2	525	0.20		4	2 3/4	1 5/16	3/4
3		0.20		3 13/16	2 15/16	1 3/16	
4	650	0.30		4 11/16	3 13/16	1 9/16	
5	1,000	0.54	1/2	5 5/16	4 3/8		
6		0.65		6 11/16	5 9/16	2 1/4	
8		1.00		8 9/16	7 9/16	3 1/4	

PROJECT INFORMATION	APPROVAL STAMP
Project:	☐ Approved
Address:	☐ Approved as noted
Contractor:	☐ Not approved
Engineer:	**Remarks:**
Submittal Date:	
Notes 1:	
Notes 2:	

Fig. AF310 (Formerly Afcon Fig. 310) Surge Restrainer

Size Range: 1" thru 2" Figure 69, Swivel Ring Hanger
Material: Carbon steel
Finish: Pre-Galvanized per ASTM A653
Restrainer Service: Prevents vertical movement of horizontal sprinkler piping from thrust loads due to sprinkler activation. The surge restrainer is intended to be installed with Anvil's Figure 69 Swivel Ring Hanger.
Restraint Service: May be installed as part of a branch line seismic restraint assembly per the requirements of NFPA 13. The surge restrainer is intended to be installed with Anvil's Figure 69 Swivel Ring Hanger.
Approvals: cULus Listed (UL 203 and UL 203a). Complies with the hanging and restraint requirements listed in NFPA 13.

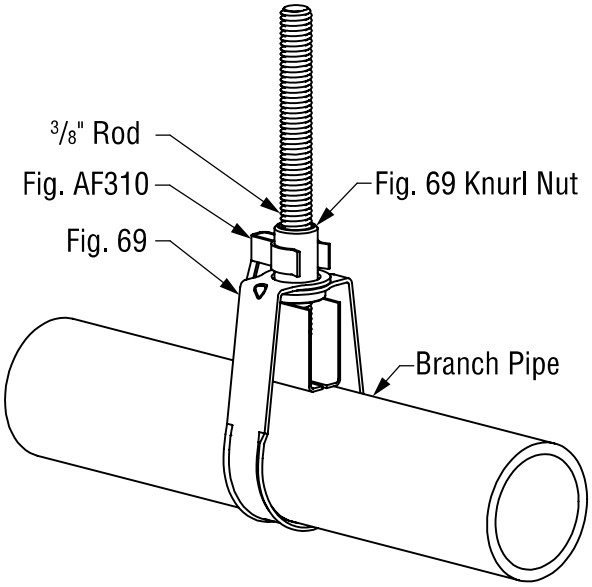
Features:

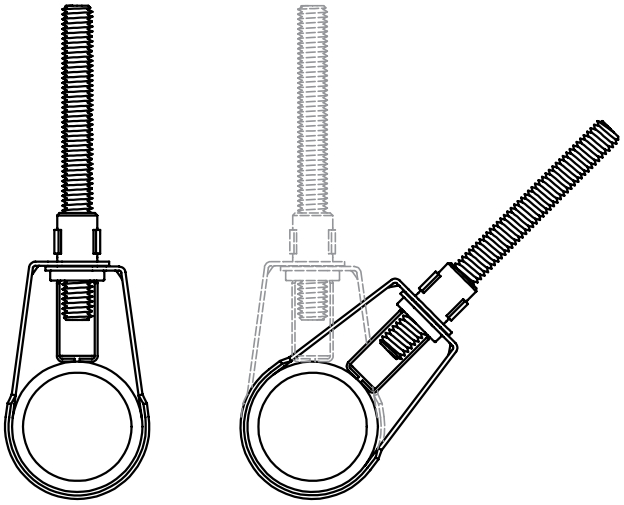
- One universal size accommodates Fig. 69 sizes 1" through 2".
- Simple design allows for quick installation on existing sprinkler systems.

Installation Instructions:

- Snap surge restrainer onto the Fig. 69 knurl nut.
- The gap between the surge restrainer and service pipe shall not exceed 1/8".
- Fire Protection applications shall also be installed per the requirements of NFPA 13.

Ordering: Specify figure number and description.





Surge Restraint Assembly **Seismic Restraint Assembly**

FIG. AF310:
LOADS (LBS) • DIMENSIONS (IN) • WEIGHT (LBS)

Service Pipe Size	Rod Size	UL Max Seismic Restraint Load (UL 203a)	Approx. Weight/100
1 thru 2	3/8	300	4

Notes: Anvil International® brand bracing components are designed to be compatible ONLY with other Anvil International® brand bracing components, resulting in a Listed seismic bracing assembly. Updated UL listing information may be viewed at www.ul.com

Disclaimer: Anvil International ("Anvil") does not provide any warranties and specifically disclaims any liability whatsoever with respect to Anvil bracing products and components that are used in combination with products, parts or systems not manufactured or sold by Anvil. In no event shall Anvil be liable for any incidental, direct, consequential, special or indirect damages or lost profits where non-Anvil bracing components have been, or are used.

PROJECT INFORMATION	APPROVAL STAMP
Project:	☐ Approved
Address:	☐ Approved as noted
Contractor:	☐ Not approved
Engineer:	Remarks:
Submittal Date:	
Notes 1:	
Notes 2:	

Fig. AF771 (Formerly Anvil Fig. 771) Sway Brace Swivel Attachment

OPM-0351-13

Size Range: Brace Pipe: 1", 1 1/4", DN25 and DN32
Anchor Size: 1/2" through 3/4"

Material: Ductile Iron with Carbon Steel Hardware

Finish: ☐ Plain or ☐ Electro-Galvanized per ASTM B633

Service: A seismic swivel attachment designed to connect brace pipe to the building structure or to a seismic structural attachment. The Sway Brace Swivel Attachment rigidly braces piping systems subjected to horizontal seismic loads. The Sway Brace Swivel Attachment may also be installed to rigidly brace piping systems subjected to vertical seismic loads. For vertical load capacities, reference OSHPD OPM-0351-13.

Approvals: cULus Listed (UL 203a) and FM Approved (FM 1950-10 & FM 1950-13). OSHPD Pre-Approved (OPM-0351-13 and OPA-2804-10). Complies with the hanging and bracing requirements listed in NFPA 13.

Features:

- Field adjustable design requires no threading of the brace pipe
- Shear off bolt provides a visual indication that the desired torque value has been achieved
- True concentric loading of the brace pipe

Installation Instructions:

- Insert anchor through the mounting hole and into the structure or seismic structural attachment.
- For connection to Fig. AF772, AF778, and AF779 seismic structural attachments, the bolt and nuts shall be installed wrench tight (typically finger tight plus 1/4 to 1/2 turns).
- For connection to concrete, wood, timber, steel, and other structures, install fasteners per the fastener manufacturer's installation instructions.
- Insert Sch. 40 brace pipe into the brace socket until the brace pipe bottoms out.
- Torque shear off bolt until head shears off.
- Check the cross bolt and nut and ensure the nut is wrench tight.
- Fire Protection applications shall also be installed per the requirements of NFPA 13 and local codes.

Ordering: Specify brace pipe size, fastener size, figure number, finish and description.

Notes: Anvil International® brand bracing components are designed to be compatible ONLY with other Anvil International® brand bracing components, resulting in a Listed seismic bracing assembly. Updated UL listing information may be viewed at www.ul.com and updated FM approval information may be viewed at www.approvalguide.com.

Disclaimer: Anvil International ("Anvil") does not provide any warranties and specifically disclaims any liability whatsoever with respect to Anvil bracing products and components that are used in combination with products, parts or systems not manufactured or sold by Anvil. In no event shall Anvil be liable for any incidental, direct, consequential, special or indirect damages or lost profits where non-Anvil bracing components have been, or are used.

SeisBrace® Seismic Fire Protection Design Tool may be accessed at www.seisbrace.com

PROJECT INFORMATION	APPROVAL STAMP
Project: Marie Bauer Preschool	☐ Approved
Address: 401 17th Street, Paso Robles, CA 93446	☐ Approved as noted
Contractor:	☐ Not approved
Engineer:	**Remarks:**
Submittal Date: September 16, 2018	
Notes 1:	
Notes 2:	

Fig. AF771 (Formerly Anvil Fig. 771) Sway Brace Swivel Attachment (cont.)

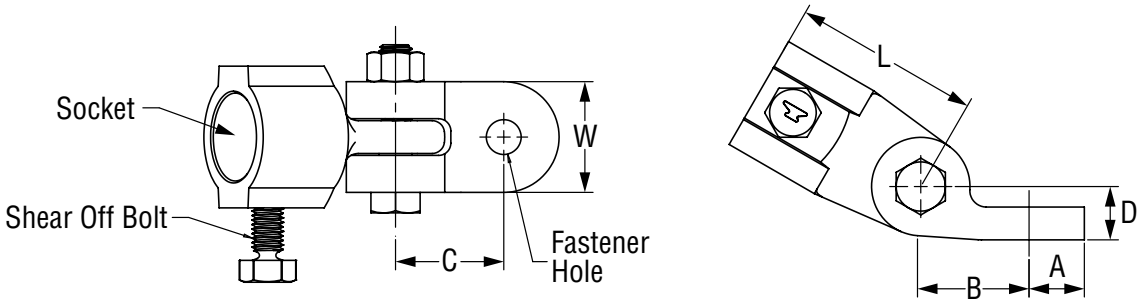


FIG. AF771: DIMENSIONS (IN) • WEIGHT (LBS)									
Brace Pipe Size	Fastener Size	A	B	C	D	W	L	Socket Depth	Weight
1 (DN25)	½ - ¾	0.84	1.65	1.65	0.81	1 11/16	2 7/8	1 3/8	1.95
1¼ (DN32)							3		2.28

FIG. AF771 cULus MAX SEISMIC HORIZONTAL LOADS: DIMENSIONS (IN) • LOADS (LBS)			
Brace Pipe Size	Fastener Size	Max Seismic Brace Load	Max Service Pipe Size
1 - 1¼ (DN25 - DN32)	½	2765	10
	⅝		
	¾	3740	12

NPS Brace Pipe Dimensions per ASTM A53 Sch. 40, ASTM A106 Sch. 40, or equivalent.
DN Brace Pipe Dimensions per KS D 3562 Sch. 40 or equivalent.

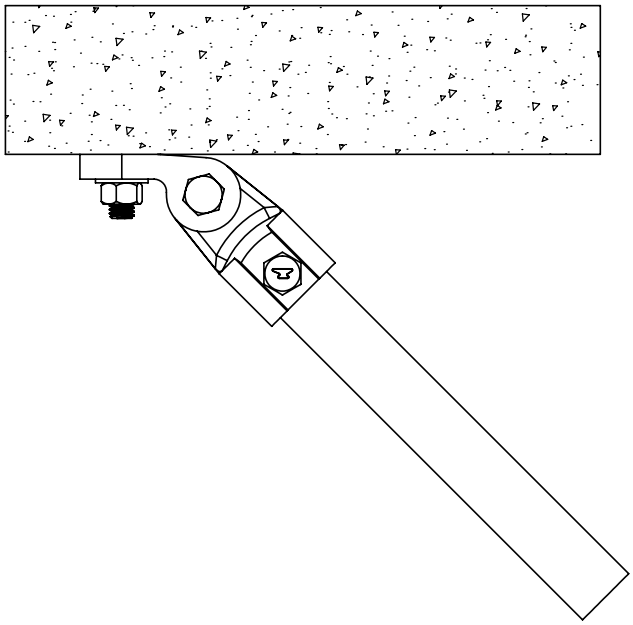


FIG. AF771 FM MAX SEISMIC HORIZONTAL ASD LOADS**: DIMENSIONS (IN) • LOADS (LBS)					
Brace Pipe Size	Fastener Size	Max Seismic Brace Load at Brace Pipe Angle*			
		30-44	45-59	60-74	75-90
1 - 1¼ (DN-25 - DN32)	½	1820	2540	3110	3470
	⅝	1520	2150	2630	2930
	¾				

NPS Brace Pipe Dimensions per ASTM A53 Sch. 40, ASTM A106 Sch. 40, or equivalent.
DN Brace Pipe Dimensions per GB/T 3091, EN10255H, JIS G3454 Sch. 40, KS D 3562 Sch. 40, or equivalent.
* Brace Pipe Angles are determined from vertical.
**The allowable FM approved capacity of brace subassemblies are listed in Allowable Stress Design (ASD). For Load Resistance Factor Design (LRFD) capacities, the above values will need to be multiplied by 1.5.

FIG. AF771 HORIZONTAL PRYING FACTORS (Pr) PER NFPA: ANGLES (DEG)									
Brace Orientation*	A	B	C	D	E	F	G	H	I
Brace Angle**	30-44	45-59	60-90	30-44	45-59	60-90	30-44	45-59	60-90
Prying Factor (Pr)	4.171	2.000	0.965	1.966	2.385	2.965	1.929	1.364	1.114

* Brace Orientation per NFPA 13-2016 Figure 9.3.5.12.1.
** Brace Pipe Angles are determined from vertical.

Fig. AF035 (Formerly Afcon Fig. 035) Model K Brace Clamp

Size Range: Carbon Steel Service Pipe: 1" through 12", DN25 through DN200
CPVC Steel Service Pipe: 1" through 3"
Brace Pipe: 1" through 2" and DN25 through DN50

Material: Carbon Steel Strap and Ductile Iron Cast Hoop Ends

Finish: ☐ Plain or ☐ Electro-Galvanized per ASTM B633

Service: Designed to rigidly brace piping systems subjected to lateral seismic loads.

Approvals: cULus Listed (UL 203a) and FM Approved (FM 1950-10 & FM 1950-13). Complies with the hanging and bracing requirements listed in NFPA 13.

Features:

- Unique design provides solutions for carbon steel and CPVC pipe.
- Beveled edge design helps protect the CPVC pipe from any rough surface and eliminates pipe abrasion.
- Large installation hole in the cast hoop ends allows the brace pipe to pass through easily without interference.
- Visual indication of proper assembly when the head of the set screw bottoms out on the cast hoop ends.

Installation Instructions:

- Place the Model K Brace Clamp over the service pipe to be braced and slide the Sch. 40 brace pipe through the cast hoop ends. The end of the brace pipe must extend at least 1" past the cast hoop ends.
- Note: The brace pipe may be installed above or below the service pipe.
- Ensure brace pipe is set to the desired installation brace angle.
- Torque the set screws alternately and equally until the head of the set screw bottoms out on the cast hoop ends.
- For riser/4-way brace installations, two Model K Brace Clamps must be installed within 6" of each other.
- For CPVC installation, ensure the legs of the Model K Brace Clamp strap are parallel to each other and perpendicular to the brace pipe prior to installation.
- Fire Protection applications shall also be installed per the requirements of NFPA 13 and local codes.

Patents: No. 7,516,922, No. 7,523,895

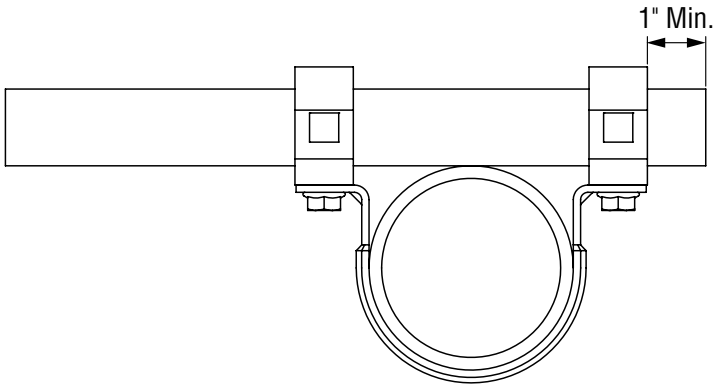
Ordering: Specify service pipe size, brace pipe size, figure number, finish and description.

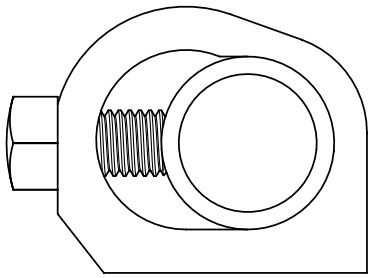
Notes: Anvil International® brand bracing components are designed to be compatible ONLY with other Anvil International® brand bracing components, resulting in a Listed seismic bracing assembly. Updated UL listing information may be viewed at www.ul.com and updated FM approval information may be viewed at www.approvalguide.com.

SeisBrace® Seismic Fire Protection Design Tool may be accessed at www.seisbrace.com

PROJECT INFORMATION	APPROVAL STAMP
Project: Marie Bauer Preschool	☐ Approved
Address: 401 17th Street, Paso Robles, CA 93446	☐ Approved as noted
Contractor:	☐ Not approved
Engineer:	**Remarks:**
Submittal Date: September 16, 2018	
Notes 1:	
Notes 2:	

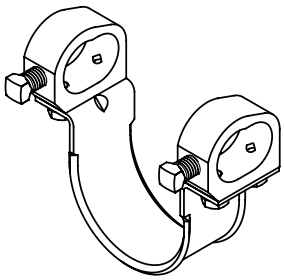
Fig. AF035 (Formerly Afcon Fig. 035) Model K Brace Clamp (cont.)



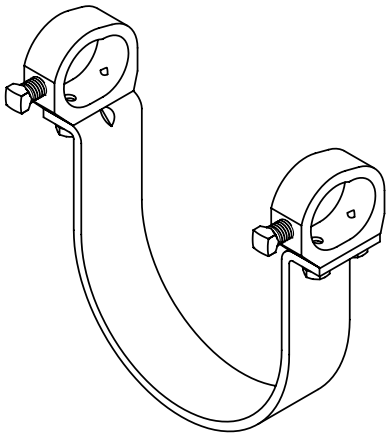


Set Screw Installation

FIG. AF035: DIMENSIONS (IN) • WEIGHT (LBS)				
Service Pipe Size	1"/DN25 Brace Pipe Weight	1¼"/DN32 Brace Pipe Weight	1½"/DN40 Brace Pipe Weight	2"/DN50 Brace Pipe Weight
1 (DN25)	1.60	1.80	2.00	2.28
1¼ (DN32)	1.68	1.88	2.08	2.36
1½ (DN40)	1.64	1.84	2.04	2.32
2 (DN50)	1.88	2.08	2.28	2.56
2½	1.90	2.10	2.30	2.58
DN65	2.00	2.20	2.40	2.68
3 (DN80)	2.10	2.30	2.50	2.78
4 (DN100)	2.20	2.40	2.60	2.88
5 (DN125)	3.40	3.60	3.80	4.08
DN150	3.80	4.00	4.20	4.48
6	3.90	4.10	4.30	4.58
DN200	4.70	4.90	5.10	5.38
8	4.80	5.00	5.20	5.48
10	5.60	5.80	6.00	6.28
12	–	6.36	6.56	6.84



1" - 4"



5" - 12"

FIG. AF035 cULus MAX SEISMIC LATERAL LOADS: DIMENSIONS (IN) • LOADS (LBS)				
Service Pipe Size	Brace Pipe Size	Max Seismic Brace Load		
		Specialty*	Schedule 10	Schedule 40
1 - 4 (DN25 - DN100)	1 - 2 (DN25 - DN50)	2765	2765	2765
5 - 10 (DN125 - DN200)		–		
12	1¼ - 2		3740	3740

NPS Brace Pipe Dimensions per ASTM A53 Sch. 40, ASTM A106 Sch. 40, or equivalent.
NPS Service Pipe Dimensions per ASTM A53, ASTM A106 or equivalent.
DN Service Pipe Dimensions per KS D 3507/3537 or equivalent listed with Sch. 10 loads.
DN Service Pipe Dimensions per KS D 3562 Sch. 40 or Equivalent listed with Sch. 40 loads.
DN Brace Pipe Dimensions per KS D 3562 Sch. 40 or equivalent.
* Specialty pipes are commonly referred to as Sch. 7 and Flow Pipe. Please visit the UL listing on the UL website for a complete list of listed specialty pipes.

Fig. AF035 (Formerly Afcon Fig. 035) Model K Brace Clamp (cont.)

FIG. AF035 FM MAX SEISMIC LATERAL ASD LOADS***: DIMENSIONS (IN) • LOADS (LBS) • ANGLES (DEGREES)						
Service Pipe Size	Brace Pipe Size	Pipe Schedule	Max Seismic Brace Load at Brace Pipe Angle**			
			30 - 44	45 - 59	60 - 74	75 - 90
1 - 1 1/2 (DN25 - DN40)	1 - 2 (DN25 - DN50)	LW* – Sch. 40	1680	2380	2920	3250
2 - 3 (DN50 - DN80)		LW* – Sch. 40	1800	2550	3120	3490
4 (DN100)		LW* – Sch. 40	1370	1930	2370	2640
5 - 8 (DN125 - DN200)		Sch. 10 – Sch. 40	730	1040	1270	1420

NPS Brace Pipe Dimensions per ASTM A53 Sch. 40, ASTM A106 Sch. 40, or equivalent.
NPS Service Pipe Dimensions per ASTM A53, ASTM A106 or equivalent.
DN Service Pipe Dimensions per EN 10220, GB/T 8163, or equivalent listed with LW loads.
DN Service Pipe Dimensions per GB/T 3091, GB/T 3092, EN10255M, EN10255H, KS D 3507/3537, or equivalent listed with Sch. 10 loads.
DN Service Pipe Dimensions per JIS G3452, KS D 3562 Sch. 40 or equivalent listed with Sch. 40 Loads.
DN Brace Pipe Dimensions per GB/T 3091, EN10255H, JIS G3454 Sch. 40, KS D 3562 Sch. 40, or equivalent.
* Load Rating for LW above refers to FM Approved Lightwall pipe, commonly referred to as Sch. 7 and Flow Pipe. See FM Approval Guide for approved Lightwall pipe.
** Brace Pipe Angles are determined from vertical.
*** The allowable FM approved capacity of brace subassemblies are listed in Allowable Stress Design (ASD). For Load Resistance Factor Design (LRFD) capacities, the above values will need to be mulitplied by 1.5.

☐ Fig. AF411 (Formerly Afcon Fig. 411) Longitudinal Seismic Clamp
☐ Fig. AF074 (Formerly Afcon Fig. 074) Brace Attachment Fitting
☐ Fig. AF078 (Formerly Afcon Fig. 078) Brace Attachment Fitting

Size Range: Service Pipe: 1" through 8" Carbon Steel
Brace Pipe: 1" through 2" Sch. 40

Material: Carbon Steel (AF074 Only: Ductile Iron Brace Socket)

Finish: ☐ Plain or ☐ Electro-Galvanized per ASTM B633

Service: Designed to rigidly brace piping systems subjected to longitudinal seismic loads. The Fig. AF411 may be installed with Fig. AF074 or AF078 Brace Attachment Fittings.

Approvals: cULus Listed (UL 203a) and FM Approved (FM 1950-10 & FM 1950-13). Complies with the hanging and bracing requirements listed in NFPA 13.

Features: Visual indication of assembly when the clamp ears make metal-to-metal contact.

Installation Instructions:

- Mount the Fig. AF074 or AF078 on the outside of the outside of the Fig. AF411 clamps ears.
- Position the clamp at the desired location on the service pipe and hand tighten the hex bolts.
- Insert brace pipe into the AF074 or AF078 socket and torque the set screw until the head bottoms out on the AF074 or AF078. Brace pipe must extend 1/2" past the end of the brace socket.
- Ensure the brace pipe is set to the desired installation brace angle.
- Tighten the clamp bolts and nuts equally and alternately until metal-to-metal contact is achieved and the nuts are wrench tight.
- Fire Protection applications shall also be installed per the requirements of NFPA 13 and local codes.

Ordering: AF411: Specify service pipe size, figure number, finish, and description.
AF074 & AF078: Specify brace pipe size, figure number, finish, and description.
AF411, AF074, & AF078 all sold separately.


Fig. AF411


Fig. AF074


Fig. AF078

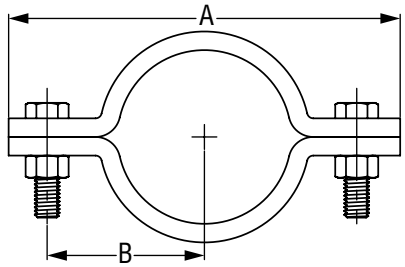
Notes: Anvil International® brand bracing components are designed to be compatible ONLY with other Anvil International® brand bracing components, resulting in a Listed seismic bracing assembly. Updated UL listing information may be viewed at www.ul.com and updated FM approval information may be viewed at www.approvalguide.com.

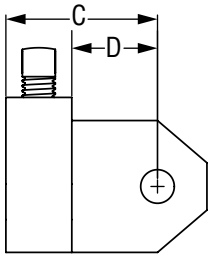
Disclaimer: Anvil International ("Anvil") does not provide any warranties and specifically disclaims any liability whatsoever with respect to Anvil bracing products and components that are used in combination with products, parts or systems not manufactured or sold by Anvil. In no event shall Anvil be liable for any incidental, direct, consequential, special or indirect damages or lost profits where non-Anvil bracing components have been, or are used.

SeisBrace® Seismic Fire Protection Design Tool may be accessed at www.seisbrace.com

PROJECT INFORMATION	APPROVAL STAMP
Project: Marie Bauer Preschool	☐ Approved
Address: 401 17th Street, Paso Robles, CA 93446	☐ Approved as noted
Contractor:	☐ Not approved
Engineer:	**Remarks:**
Submittal Date: September 16, 2018	
Notes 1:	
Notes 2:	

Fig. AF411 (Formerly Afcon Fig. 411) Longitudinal Seismic Clamp
Fig. AF074 (Formerly Afcon Fig. 074) Brace Attachment Fitting
Fig. AF078 (Formerly Afcon Fig. 078) Brace Attachment Fitting





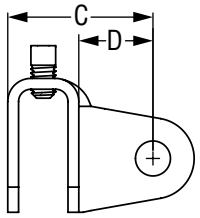


FIG. AF411: DIMENSIONS (IN) • WEIGHT (LBS)

Service Pipe Size	A	B	Weight
1	5⅝	2⅛	1.75
1¼	6	2¼	1.90
1½	6⅛	2¼	2.00
2	6¾	2½	2.15
2½	7⅜	2⅞	2.40
3	7⅞	3⅛	2.60
4	9	3⅞	3.10
6	11½	4⅞	4.50
8	13½	5⅞	5.50

FIG. AF074 & AF078: DIMENSIONS (IN) • WEIGHT (LBS)

Brace Pipe	AF074			AF078		
	C	D	Weight	C	D	Weight
1	2³⁄₁₆	1⁷⁄₁₆	0.97	2⁵⁄₁₆	1⅛	0.38
1¼			1.07			0.54
1½			1.17			
2			1.31			

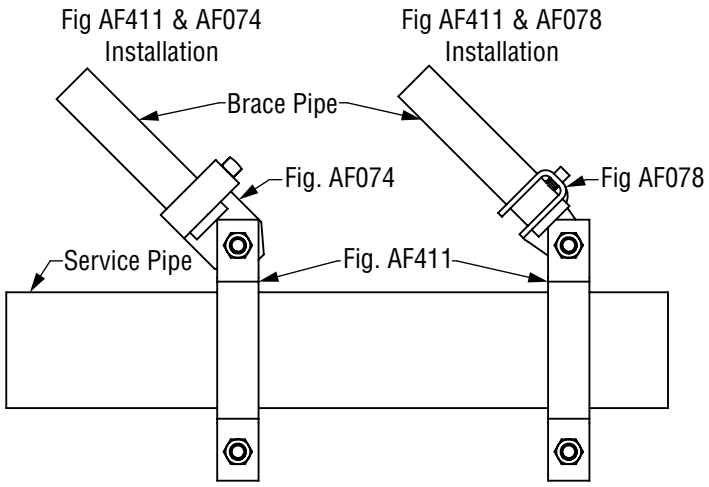


FIG. AF411 cULus MAX SEISMIC LONGITUDINAL LOADS: DIMENSIONS (IN) • LOADS (LBS)

Service Pipe size	Brace Attachment Fitting	Brace Pipe Size	Max Seismic Brace Load	
			Sch. 10	Sch. 40
1	AF074	1 – 2	—	2015
	AF078	1 – 1¼	—	1000
1¼ – 4	AF074	1 – 2	2015	2015
	AF078	1 – 1¼	1000	1000
6 – 8	AF074	1 – 2	2015	2015

Fig. AF411 (Formerly Afcon Fig. 411) Longitudinal Seismic Clamp
Fig. AF074 (Formerly Afcon Fig. 074) Brace Attachment Fitting
Fig. AF078 (Formerly Afcon Fig. 078) Brace Attachment Fitting

FIG. AF411 FM MAX SEISMIC LONGITUDINAL ASD LOADS*: DIMENSIONS (IN) • LOADS (LBS) • ANGLES (DEG)**

Service Pipe Size	Pipe Schedules	Brace Attachment Fitting	Brace Pipe Size	Max Seismic Brace Load at Brace Pipe Angle**			
				30-44	45-59	60-74	75-90
1 – 1 1/2	Sch. 10 – Sch. 40	AF074	1 – 2	1070	420	510	570
		AF078	1 – 1 1/4	430	420	510	570
2	LW – Sch. 40	AF074	1 – 2	1410	1900	1730	1930
		AF078	1 – 1 1/4	430	620	760	840
2 1/2 – 3	LW – Sch. 40	AF074	1 – 2	1000	860	1030	1150
		AF078	1 – 1 1/4	430	620	760	840
4	LW	AF074	1 – 2	1000	860	1030	1150
		AF078	1 – 1 1/4	430	620	760	840
	Sch. 10 – Sch. 40	AF074	1 – 2	1000	950	1150	1280
		AF078	1 – 1 1/4	430	620	760	840
6	LW – Sch. 40	AF074	1 – 2	1410	2000	2450	2740
		AF078	1 – 1 1/4	430	620	760	840
8	Sch. 10 – Sch. 40	AF074	1 – 2	1410	1250	1510	1690
		AF078	1 – 1 1/4	430	620	760	840

* Load rating for LW above refers to FM Approved Lightwall pipe, commonly referred to as Sch.7 and Flow Pipe. See FM Approval Guide for approved Lightwall pipe.
** Brace Pipe Angles are determined from vertical.
*** The allowable FM approved capacity of brace subassemblies are listed in Allowable Stress Design (ASD). For Load Resistance Factor Design (LRFD) capacities, the above values will need to be multiplied by 1.5.

FIBERGLAS™ Pipe Insulation

SSL II® with ASJ Max | No-Wrap

Description

Owens Corning® FIBERGLAS™ Pipe Insulation is molded of heavy density resin bonded inorganic glass fibers that come in one-piece, 36" (914mm) long, hinged sections. Sections can be order as factory applied SSL II® with ASJ Max, or as unjacketed No-Wrap.

Applications

- Used to insulate iron, copper, and PVC pipes with operating temperatures between 0°F (-18°C) to 1,000°F (538°C) (with heat up schedule) in commercial & institutional buildings, and industrial facilities
- When installed outdoors an additional weather-protective jacket is required
- No Wrap is intended for field installation with jacketing appropriate to the vapor control, damage, or corrosion resistance requirements of the application
- Also available in select metric sizes for use with Aquatherm® pipe systems. (See dimensional bulletin for metric sizing availability: Pub. No. 10018078)

Physical Properties

Property	Test Method	Value
Density (size dependent)	ASTM C302	3.5 to 5.5 pcf
Operating Temperature Range[1]	ASTM C411	0°F to 1,000°F[2] (-18°C to 538°C)
Water Vapor Sorption	ASTM C1104	Less than 5% by weight
Corrosion	ASTM C665	Pass – steel, copper, or aluminum
Jacket Temperature Limitation	ASTM C1136	-20°F to 150°F (-29°C to 66°C)
Jacket Permeance	ASTM E96, Proc. A	0.02 perm
Burst Strength, min	ASTM D774/D774M	100 psi
Composite Surface Burning Characteristics[3]	UL 723, ASTM E84 or CAN/ULC-S102	Flame Spread 25 Smoke Developed 50

1. Limited to single layer applications above 650°F (343°C), but not greater than 6" (152mm) thickness.
2. With heat up schedule.
3. The surface burning characteristics of these products have been determined in accordance with UL 723, ASTM E84 or CAN/ULC-S102. Values are reported to the nearest 5 rating.

Features

- All-service-jacket with a polymer film exterior surface that is smooth, durable, cleanable, wrinkle-resistant, resists water staining and doesn't support mold or mildew growth[4]
- SSL II® Positive Closure System with a new, advanced adhesive that fastens and installs with no need for staples or mastic
- ASJ Max can resist short durations of water exposure that may occur during construction
- The product has a maximum operating temperature of 1,000°F (538°C) (with heat up schedule)
- The product does not contain Polybromodiphenyl ethers (PBDE) (penta-, octa-, or deca-brominated diphenyl)
- UL Labeled for Flame Spread Index of 25 or less and Smoke Developed Index of 50 and is fully building code compliant

4. ASJ Max jacket does not support mold growth as tested in accordance with ASTM C1338.

Standards, Codes Compliance

- ASTM C547, Mineral Fiber Pipe Insulation, Types I and IV
- ASTM C585, Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing
- ASTM C1136, Flexible Low Permeance Vapor Retarders for Thermal Insulation: Types I, II, III, IV
- ASTM C795, Thermal Insulation for Use in Contact with Austenitic Stainless Steel[5]
- MIL-PRF-22344E, Insulation, Pipe, Thermal, Fibrous Glass
- Nuclear Regulatory Commission Guide 1.36, Non-Metallic Thermal Insulation[5]
- MIL-DTL-24244D (Ships) Insulation Material with Special Corrosion, Chloride, and Fluoride Requirements[5]
- US Coast Guard 164.109/70/0 Non-Combustible (No-Wrap only)
- NFPA 90A and 90B

5. Preproduction qualification testing complete and on file. Chemical analysis of each production lot required for total conformance. Certification needs to be specified at time of order.

Thermal Conductivity

Mean Temperature °F	k Btu•in/hr•ft2•°F	Mean Temperature °C	λ W/m•°C
50	0.22	10	0.032
75	0.23	25	0.034
100	0.24	50	0.037
150	0.27	100	0.043
200	0.29	125	0.047
250	0.32	150	0.051
300	0.35	175	0.056
350	0.39	200	0.062
400	0.43	225	0.068
450	0.48	250	0.075
500	0.54	275	0.082

Apparent thermal conductivity values determined in accordance with ASTM practice C1045 with data obtained by ASTM Test Method C335. Values are nominal, subject to normal testing and manufacturing tolerances.

Thickness to Prevent Surface Condensation

Owens Corning® ASJ Max Jacket for up to 16" NPS (400mm DN), in. (mm) [6, 7]

Ambient Temperature °F	Ambient Temperature (°C)	Relative Humidity	System Operating Temperatures 35˚F	(2˚C)	45˚F	(7˚C)	55˚F	(13˚C)
110	(43)	70%	1	(25)	1	(25)	1	(25)
		80%	1½	(38)	1½	(38)	1½	(38)
		90%	3½	(89)	3½	(89)	3	(76)
100	(38)	70%	1	(25)	1	(25)	1	(25)
		80%	1½	(38)	1 ½	(38)	1	(25)
		90%	3½	(89)	3	(76)	2½	(64)
90	(32)	70%	1	(25)	1	(25)	1	(25)
		80%	1½	(38)	1	(25)	1	(25)
		90%	3½	(89)	3	(76)	2½	(64)
80	(27)	80%	1½	(38)	1	(25)	1	(25)
		90%	3	(76)	2½	(64)	2	(51)
70	(21)	80%	1	(25)	1	(25)	1	(25)
		90%	2½	(64)	2	(51)	1	(25)

6. Calculations estimated using NAIMA 3E Plus version 4.0 software. Fixed design conditions: Steel Horizontal Piping, 16" NPS, 0 mph wind speed, Outer Surface Jacket Emittance of 0.9.
7. Thermal conductivity values used in these calculations are subject to normal manufacturing tolerances.

Installation

- Ambient application temperatures are from 25°F (-4°C) to 110°F (43°C).
- For complete installation instructions and recommendations see “FIBERGLAS™ Pipe Insulation Installation Instructions” (Pub. No. 10021355).

Availability

FIBERGLAS™ Pipe Insulation are available in thicknesses for NPS and NTS pipe sizes as follows[8]

Insulation Thickness in.	(mm)	Nominal Pipe Size in.	(mm)
½	(13)	½–2½	(15–65)
1	(25)	½–33	(15–825)
1½	(38)	½–33	(15–825)
2	(51)	½–33	(15–825)
2½	(64)	½–32	(15–800)
3	(76)	½–31	(15–775)
3½	(89)	½–30	(15–750)
4	(102)	½–29	(15–725)
4½	(114)	½–28	(15–700)
5	(127)	½–27	(15–675)

8. Please refer to product packaging and data guide for load factors, standard products, and minimum order quantity and carton sizes. Contact your customer service representative for product lead time.

NOTE: Most pipe sizes at 4½" and 5" insulation thickness are made-to order (MTO). Consult your local Owens Corning sales representative.

Environmental and Sustainability

Owens Corning is a worldwide leader in building material systems, insulation and composite solutions, delivering a broad range of high-quality products and services. Owens Corning is committed to driving sustainability by delivering solutions, transforming markets and enhancing lives. More information can be found at www.owenscorning.com.

Notes

For additional information, refer to the Safe Use Instruction Sheet (SUIS) found in the SDS Database via http://sds.owenscorning.com

Certifications and Sustainable Features

- Certified by SCS Global Services to contain a minimum of 53% recycled glass content, 31% pre-consumer and 22% post-consumer
- GREENGUARD Certified products are certified to GREENGUARD standards for low chemical emissions into indoor air during product usage. For more information, visit ul.com/gg*
- Environmental Product Declaration (EPD) has been certified by UL Environment*
- Material Health Certificate from Cradle to Cradle Products Innovation Institute

*Does not include No Wrap Pipe Insulation

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OWENS CORNING INSULATING SYSTEMS, LLC
ONE OWENS CORNING PARKWAY
TOLEDO, OHIO, USA 43659

1-800-GET-PINK®
www.owenscorning.com

Pub. No. 20547-R. Printed in U.S.A. July 2016.

FIBERGLAS™ Pipe Insulation Installation Instructions

SSL II® with ASJ Max:

1. Ambient application temperatures are from 25°F (-4°C) to 110°F (43°C).
2. To open the hinged insulation section, pull the lap with the release strip from the jacket.
3. Open the hinged sections and place the insulation over the pipe, taking care not to get dirt, dust or moisture on the overlap area. While preparing to close the insulation, take care not to allow the adhesive on the jacket to contact anything until the insulation is properly lined up and closed over the pipe.
4. Pull the release strip from the jacket lap. Start by pulling the lap down at the middle until the adhesive touches the adhesive strip on the jacket. Press together. Rub firmly with nylon sealing tool or squeegee from the middle of the section towards the end until the lap is securely adhered to the jacket.
5. Apply the matching butt strip centered over the adjoining pipe sections, and rub with firm pressure to complete the positive closure.
6. If the operating temperature of the system is above 100°F (37°C), it is recommend that if the pipe insulation terminates with an exposed end, apply mastic over the exposed end, per the mastic manufacturer's instructions.
7. If the operating temperature of the system is below 100°F (37°C), the pipe insulation terminated exposed end shall be sealed with a vapor barrier mastic applied over the exposed end per the mastic manufacturer's instructions.
8. Apply systems identification labels by pressure-sensitive labels, or by stencil with spray paint.

SSL II® with ASJ Max on Chilled Systems:

For systems that operate at 60° F and lower, install per North American Insulation Manufactures Association (NAIMA) manual titled: GUIDE TO INSULATING CHILLED WATER PIPING SYSTEMS WITH MINERAL FIBER PIPE INSULATION (33°F to 60°F (0.5°C to 15.6°C)); Pub. No. CI 228.

No Wrap:

1. Open the hinged sections and place over the pipe, carefully aligned and secured by wires or bands.
2. Jacket and vapor seal as required by the application.

Additional Installation Instructions:

1. Outdoor applications must be protected from weather.
2. If painting is required, use only water based latex paint.

Installation Guidelines for ITW Insulation Systems Metal Jacketing Used on Insulated Pipe

1 SCOPE

1.1 This guideline covers the installation of ITW Insulation Systems Pabco-Childers brand aluminum and stainless steel jacketing products on insulated pipe including elbows, valves, and other fittings.

1.2 Product data sheets and other ITW literature are referenced throughout this guideline. Visit www.itwinsulation.com for the latest version of these documents.

1.3 The information contained in this guideline and referenced ITW documents are current as of December 2016. This guideline is subject to revision without notice. Visit www.itwinsulation.com or contact the ITW Insulation Systems Customer Information Group at 1-800-231-1024 or your local ITW representative for the most recent version of this guideline or other ITW referenced literature.

1.4 Due to the variations in service conditions and use, this guideline may not be pertinent for every application. A design or specifying engineer can create specifications tailored to particular applications or owner's needs. Such a design or specification engineering service may be more familiar with local conditions, budgets, environment, and desired service life of the system allowing them to generate a more precise specification.

1.5 It is the intent of this document to provide guidelines for the installation of ITW Insulation Systems Pabco-Childers brand aluminum and stainless steel insulation jacketing products. This guideline may not be suitable and shall not be used for the purpose of installing another insulation manufacturer's products. While supplemental insulation system products may be referenced in this guideline, ITW recommends consulting the manufacturers of such products for proper installation and handling.

1.6 **This guideline is offered as a guide for the purpose described herein. No warranty of procedures, either expressed or implied is intended. All other express or implied warranties of merchantability or fitness for a particular purpose are disclaimed.**

2 GENERAL

2.1 All surfaces shall be free of foreign substances prior to the application of insulation jacketing.

2.2 All jacketing material shall be delivered to the project site in original unbroken factory packaging labeled with product designation and metal thickness.

2.3 Metal jacketing shall be stored in a dry area before use. Water staining may occur due to improper storage before installation.

2.4 All testing of piping systems shall be completed prior to the installation of the insulation system.

3 MATERIALS OF CONSTRUCTION

3.1 METAL JACKETING MATERIALS FOR PIPE AND FITTINGS – GENERAL

3.1.1 Insulation jacketing shall be aluminum and/or stainless steel roll or cut & roll jacketing, elbows, and accessories manufactured by ITW Insulation Systems.

3.1.2 Aluminum or stainless steel protective jacketing shall not be considered a vapor retarder.

3.1.3 A pipe coating system may be recommended to minimize the likelihood of corrosion of the underlying pipe. Refer to Appendix A for conditions where pipe coating systems are suggested.

3.1.4 Where required, safety edges or safety hems may be used on metal jacketing. A safety edge consists of a de-burred or rounded edge. A safety hem shall be folded such that the original edge is on the underside of the jacketing and shall be ⅜" to ½" in width. A safety hem shall not be used on 3/16" or deep corrugated jacketing.

3.2 ALUMINUM JACKETING

3.2.1 Aluminum jacketing shall comply with the requirements of ASTM C1729 *Standard Specification for Aluminum Jacketing for Insulation* and shall be classified per ASTM C1729 as follows:

- 3.2.1.1 Standard Roll or Sheet Aluminum Jacketing
  - 3.2.1.1.1 Properties: Bare surface, 3105/3003 alloy, H14 temper, 3 mil polyfilm moisture barrier
  - 3.2.1.1.2 Classification: Type I, Grade 1, Class A, 0.016-0.024" thick
- 3.2.1.2 Standard Roll or Sheet Aluminum Jacketing for Extra Corrosive Environments
  - 3.2.1.2.1 Properties: Painted surface, 3105/3003 alloy, H14 temper, 3 mil polyfilm moisture barrier
  - 3.2.1.2.2 Classification: Type II, Grade 1, Class A, 0.016-0.024" thick
- 3.2.1.3 Heavy Duty Sheet or Roll Aluminum Jacketing for High Abuse Areas
  - 3.2.1.3.1 Properties: Bare surface, 3105/3003 alloy, H12 temper, 3 mil polyfilm moisture barrier
  - 3.2.1.3.2 Classification: Type I, Grade 2, Class A, ≥0.032" thick
- 3.2.1.4 Ell-Jacs Plus Two-Piece Aluminum Elbows
  - 3.2.1.4.1 Properties: Clear painted outer surface, 1100 alloy, 0 temper, polyfilm moisture barrier
  - 3.2.1.4.2 Classification: Type III, Grade 3, Class A, 0.024" thick
- 3.2.1.5 Deep Corrugated Aluminum Sheet Jacketing
  - 3.2.1.5.1 Properties: Bare or painted surface, 3105/3003 alloy, H14 or H12 temper, 3 mil polyfilm moisture barrier
  - 3.2.1.5.2 Classification: Type I or II, Grade 1 or 2, Class A, 0.016-0.040" thick
- 3.2.1.6 Box Rib Aluminum Sheet Jacketing
  - 3.2.1.6.1 Properties: Bare surface, 3004 or Alclad 3004 alloy, no moisture barrier
  - 3.2.1.6.2 Classification: Type I, Grade 4 or 5, Class E, 0.032-0.050" thick

3.2.2 The aluminum jacketing alloys shall comply with the requirements of ASTM B209.

3.2.3 Aluminum roll and cut & roll jacketing shall have a 3 mil thick polyfilm moisture barrier factory heat laminated to the inside surface to help prevent corrosion of the interior surface of the jacketing.

3.2.4 Where required, white painted aluminum jacketing shall be used to raise the emissivity of metal jacketing to reduce the likelihood of condensation in cold pipe applications, reduce the burn potential in hot pipe applications, or reduce the insulation thickness. Consult ITW Insulation Systems for more information.

3.2.5 Painted aluminum jacketing shall be used for higher corrosion resistance in some applications. Consult ITW Insulation Systems for jacketing finish recommendations for corrosive environments

3.2.6 Refer to Table 1 in Appendix B for recommended aluminum jacketing thickness based on outer diameter of insulation and compressive strength of the insulation.

3.2.7 **Aluminum Elbows/Fittings and Irregular Surfaces**

3.2.7.1 Aluminum jacketing for 90° and 45° pipe elbows/fittings shall be two-piece pressed elbow covers from ITW Insulation Systems where available in required sizes. Refer to Table 3, Table 4, Table 5, and Table 6 in Appendix B or the ITW Insulation Systems Fitting Selection Guide for sizing information.

3.2.7.2 For some larger pipe sizes where two-piece pressed elbow covers are not available, aluminum jacketing for 90° elbows/fittings shall be four-piece pressed elbow covers from ITW Insulation Systems (available for limited pipe sizes and insulation thicknesses between 10” and 18” NPS). Consult Table 3 in Appendix B or the ITW Insulation Systems Fitting Selection Guide for sizing information.

3.2.7.3 For larger size elbows/fittings where two or four piece pressed elbow covers are unavailable, aluminum elbows shall be gores fabricated to fit closely around insulation.

3.2.7.4 Aluminum jacketing for tees, valves, flanges, caps, etc. shall be factory or field-fabricated to fit closely around insulation.

3.2.7.5 Aluminum pressed elbow covers shall have a gold colored acrylic or polyester painted moisture barrier on the interior surface to help prevent corrosion of the interior surface of the jacketing.

3.2.7.6 Aluminum pressed elbow covers shall have a factory applied, baked on finish of highly durable hard film clear acrylic or polyester paint on the exterior surface to help prevent external corrosion and to raise the emittance.

3.3 STAINLESS STEEL JACKETING

3.3.1 Stainless steel jacketing shall comply with the requirements of ASTM C1767 *Standard Specification for Stainless Steel Jacketing for Insulation* and shall be classified per ASTM C1767 as follows:

3.3.1.1 Standard Roll or Sheet Stainless Steel Jacketing

3.3.1.1.1 Properties: Bare surface, T304/T304L alloy, annealed temper, 3 mil polyfilm moisture barrier

3.3.1.1.2 Classification: Type I, Grade 1, Class A, 0.010-0.024” thick

3.3.1.2 Standard Roll or Sheet Stainless Steel Jacketing for Extra Corrosive Environments

3.3.1.2.1 Properties: Bare surface, T316/T316L alloy, annealed temper, 3 mil polyfilm moisture barrier

3.3.1.2.2 Classification: Type I, Grade 2, Class A, 0.010-0.024” thick

3.3.1.3 Two-Piece Stainless Steel Elbows

3.3.1.3.1 Properties: Bare surface, T316/T316L alloy, annealed temper

3.3.1.3.2 Classification: Type I, Grade 2, Class E, 0.016" thick

3.3.1.4 Deep Corrugated Stainless Steel Sheet Jacketing

3.3.1.4.1 Properties: Bare surface, T304/T304L or T316/T316L alloy, annealed temper, 3 mil polyfilm moisture barrier

3.3.1.4.2 Classification: Type I, Grade 1 or 2, Class A, 0.010-0.024" thick

3.3.2 The stainless steel jacketing alloys shall comply with the requirements of ASTM A240.

3.3.3 Stainless steel roll and cut & roll jacketing shall have a 3 mil thick polyfilm moisture barrier factory heat laminated to the inside surface to help prevent corrosion of the interior surface of the jacketing.

3.3.4 Stainless steel jacketing shall be used when its superior flame or corrosion resistance is required. Consult ITW Insulation Systems for stainless steel alloy recommendations for corrosive environments.

3.3.5 Refer to Table 2 in Appendix B for recommended stainless steel jacketing thickness based on outer diameter of insulation and compressive strength of the insulation.

3.3.6 **Stainless Steel Elbows/Fittings and Irregular Surfaces**

3.3.6.1 Stainless steel jacketing for 90° and 45° pipe elbows/fittings shall be two-piece pressed elbows from ITW Insulation Systems where available in required sizes. Refer to Table 3, Table 4, and Table 5 in Appendix B or the ITW Insulation Systems Fitting Selection Guide for sizing information.

3.3.6.2 For larger size elbows/fittings where pressed elbow covers are unavailable, stainless steel elbows shall be gores fabricated to fit closely around insulation.

3.3.6.3 Stainless steel jacketing for tees, valves, flanges, caps, etc. shall be factory or field-fabricated to fit closely around insulation.

3.4 BANDING

3.4.1 For aluminum jacketing and aluminum elbow covers, banding can be aluminum or stainless steel. Due to the tensile strength characteristics, stainless steel banding shall be used in most applications.

3.4.2 **Aluminum Banding**

3.4.2.1 Aluminum banding shall only be used where all of the following apply:

- Aluminum jacketing and fitting covers are used.
- The thickness of the aluminum jacketing does not exceed that of the banding.
- The banding will not be subjected to excessive forces due to wind load, expansion/contraction of the insulation system, or other factors.
- The environment is not particularly corrosive.
- The insulation outer diameter is ≤8".
- A non-rigid insulation material is used.

3.4.2.2 Where the above criteria are met, aluminum banding for roll, cut & roll, and elbow applications shall be 0.020" thick by ½" or ¾" wide and composed of alloys 3105 or 3003.

3.4.3 **Stainless Steel Banding**

3.4.4 For applications that do not meet all of the above criteria in section 3.4.2.1, including all applications with stainless steel jacketing and stainless steel elbow covers, stainless steel banding shall be used.

3.4.5 Stainless steel banding for roll, cut & roll, and elbow applications shall be 0.020" thick stainless steel composed of alloys T304 or T316 with annealed temper. For all outer insulation diameters (OD) less than 16", ½" wide or ¾" wide stainless steel banding shall be used. For 16" OD and above, ¾" wide stainless steel banding shall be used.

3.4.6 Although 0.020" thick stainless steel banding is recommended for all pipe sizes, 0.015" stainless steel banding may be acceptable for small diameter piping with non-rigid insulation.

3.5 WING SEALS

3.5.1 The material and width of wing seals selected shall match that of the banding selected.

3.5.2 Aluminum wing seals shall be 0.032" thick by ½" or ¾" wide and composed of alloys 3105 or 3003.

3.5.3 Stainless steel wing seals shall be 0.032" thick by ½" or ¾" wide and composed of alloys T304 or T316 with annealed temper.

3.6 TENSIONERS

3.6.1 Banding shall be applied using the MIP 1800 Pusher Bar Tensioner (also known as a pistol grip tensioner).

3.6.2 If preferred for large diameter pipe with ¾" wide banding, banding may be applied using the MIP 1900 Windlass Pusher Tensioner (also known as a ratchet tensioner).

3.6.3 For applications in confined areas, the MIP 1920 Compact Windlass Pusher Tensioner may be preferred due to its shorter handles.

3.7 SCREWS/FASTENERS

3.7.1 In applications where the pipe temperature is cold (below ambient temperature), rivets, screws, staples, or any other fastener capable of penetrating the underlying vapor retarder shall NOT be used to secure the metal jacketing. These types of fasteners shall only be used on systems operating at above ambient temperature that do not have a vapor retarder.

3.7.2 If screws are the attachment method, #8x½" stainless steel screws shall be used.

3.8 JACKETING/FLASHING SEALANTS

3.8.1 Jacketing/flashing sealants shall be vapor retarder type, moisture and water resistant, non-hardening, and flexible with a service temperature range from -40°F to 250°F.

3.8.2 Flashing sealants shall be used to seal around protrusions, insulation terminations, and jacketing slip joints.

3.8.3 Typical flashing and jacketing sealants include Childers Chil-Byl CP-76 and Foster Elastolar 95-44 from H.B. Fuller Construction Products Inc. (www.fosterproducts.com) or approved equal. Consult sealant manufacturer for recommended products.

4 APPLICATION

4.1 METAL JACKETING APPLICATION - GENERAL

4.1.1 Refer to sections 3.2 and 3.3 for material specifications for aluminum and stainless steel jacketing, respectively.

4.1.2 Metal jacketing shall be used for all piping or equipment located outdoors including, but not limited to, process areas, rooftops and rooftop equipment.

4.1.3 Metal jacketing shall be used indoors where greater resistance to physical damage is required, for appearance, for improved fire resistance, or as otherwise preferred.

4.1.4 Before jacketing is installed on a portion of the piping, any vapor retarder system on that portion must be complete and continuous.

4.1.5 Metal jacketing shall be applied over dry insulation or vapor retarder.

4.1.6 In applications where the pipe temperature is cold (below ambient temperature), rivets, screws, staples or any other fastener capable of penetrating the underlying vapor retarder shall NOT be used to secure the metal jacketing. Bands shall be used in this application. Refer to Figure 1.

4.1.7 All fasteners and bands shall be neatly aligned and overall work must be of high quality appearance and workmanship.

4.1.8 Roll or cut & roll jacketing shall be cut and rolled to conform reasonably to the outer circumference of the insulation on the pipe.

4.1.9 Metal jacketing shall be applied in a continuous fashion through pipe hangers or supports. Refer to Figure 2.

4.2 JACKETING OVERLAPS

4.2.1 Metal jacketing overlaps at joints shall be positioned in an orientation to best avoid water infiltration. Whenever possible, openings at joints shall point downward or away from prevailing winds to naturally shed water

4.2.2 Refer to Figure 3, Figure 4, Figure 5, and Figure 6 for diagrams of longitudinal and butt (circumferential) joints and elbow heel and throat as indicated in this guide.

4.2.3 Metal jacketing overlaps shall be a minimum of 2” at butt joints between straight pipe jacketing sections.

4.2.4 Metal jacketing overlaps at butt joints between elbows and straight pipe jacketing shall be of sufficient length to avoid gaps and the joint oriented to naturally shed water or face away from prevailing winds.

4.2.5 On straight pipe, the longitudinal overlap shall be a minimum of 2” at less than 16” outer insulation diameter. A minimum 3” overlap shall be used on 16” outer insulation diameter and above.

4.2.6 On horizontal straight pipe, the longitudinal joint shall be located at the 3 to 4 o’clock or 8-9 o’clock position and the joint opening shall point downward in order to shed water. Refer to Figure 3 and Figure 5.

4.2.7 On vertical straight pipe, each higher jacketing piece shall overlap the piece below it at butt joints in order to shed water.

4.2.8 The overlap of aluminum elbow covers shall be a minimum of 5/8" at both the heel and throat (longitudinal) joints when the insulation outer diameter conforms to ASTM C585 or C450.

4.2.9 The heel and throat joints of two-piece elbow covers shall be oriented such that the openings point downward in order to shed water. This means that for horizontal elbows, the top piece shall overlap the bottom piece at both the heel and throat joints. The direction of heel and throat overlap for vertical elbow covers should be such that the resulting joints face away from any prevailing winds.

4.2.10 Where elbows meet vertical straight pipe, the butt joints shall be installed such that the opening points downward in order to shed water. For the elbow at the top of vertical straight pipe, the elbow cover shall be positioned on top of the straight pipe jacketing below it. For elbows located at the bottom of vertical straight pipe, the straight pipe jacketing shall be positioned on top of the elbow cover below it.

4.2.11 Where elbows meet horizontal straight pipe, the butt joints shall be installed such that the opening of the resulting joints point away from any prevailing winds.

4.3 JACKETING/FLASHING SEALANT

4.3.1 Jacketing sealant shall be applied to all longitudinal and circumferential/butt joints in the metal jacketing. This includes both elbows and straight runs of pipe.

4.3.2 Jacketing sealant shall be applied in the jacketing joint between the overlapping pieces of metal and not as a bead of caulk on the exterior lip of the jacketing joint. Refer to Figure 7.

4.3.3 Butyl sealants, such as those described in section 3.8, adhere well to both metal jacketing and polyfilm moisture barrier.

4.3.4 Jacketing sealant shall be applied before closing and banding.

4.4 ATTACHMENT METHODS

4.4.1 On cold systems or any system where a continuous vapor retarder is desired, banding shall be used to secure the jacketing and screws, rivets, or other fasteners capable of penetrating an underlying vapor retarder shall not be used. On hot systems or where a continuous vapor retarder is not required, banding, screws, or rivets can be used at the discretion of the contractor, owner, or specification writer.

4.4.2 **Banding**

4.4.2.1 Banding shall be used to attach metal jacketing on all systems operating at below ambient temperatures or where a vapor retarder is desired and is the most common method of attachment, hot or cold.

4.4.2.2 Refer to section 3.4 for material specifications for banding.

4.4.2.3 Refer to section 3.6 for information on tensioners. Refer to the following website for operating instructions for using these tensioners: http://www.miptools.com/Products/SteelPackagingTools/tabid/822/Default.aspx

4.4.2.4 Butt/end joints shall be secured with bands and seals centered directly over joint. This includes joints between two straight sections of jacketing, where straight jacketing meets an elbow, and other circumferential joints.

4.4.2.5 Straight sections of jacketing shall be neatly secured with bands and seals with a maximum spacing of 12" on center. For a 36” jacket section, two bands shall be installed evenly spaced between the bands over the two end joints.

4.4.2.6 In addition to banding at the overlap with straight jacketing, banding used to secure metal elbow covers shall be applied between the raised “fingers”, tightened, and secured using a wing seal. The number of bands required for securing elbow covers varies with size.

4.4.2.7 Refer to Figure 3 and Figure 4 for banding details for straight pipe jacketing and elbow covers, respectively.

4.4.2.8 Banding and wing seals shall be factory-fabricated Fabstraps (banding with wing seals attached) or field-fabricated. Refer to Figure 8 for details on making and applying Fabstraps.

4.4.2.9 The tension applied to the banding during installation shall be great enough to prevent the banding from sliding from its original position when exposed to normal expansion and contraction. Follow the manufacturer’s instructions for proper use of tensioners and sealers.

4.4.2.10 S-clips or z-clips may be used when needed between vertical pieces of jacketing. These are typically formed by bending banding into three successive 3” long sections to form a Z shape which interfaces between two neighboring pieces of vertical jacketing to hold them in place one on top of the other.

4.4.3 **Screws/Fasteners**

4.4.3.1 On hot systems or where a continuous vapor retarder is not required, banding, screws, or rivets can be used at the discretion of the contractor, owner, or specification writer.

4.4.3.2 In applications where the pipe is cold (below ambient temperature), rivets, screws, staples, or any other fastener capable of penetrating the underlying vapor retarder shall NOT be used to secure the metal jacketing.

4.4.3.3 Refer to section 3.7 for material specifications for screws.

4.4.3.4 Screws shall be installed at a maximum spacing of 6” on center on the longitudinal joint of straight pipe jacketing sections. Refer to Figure 5.

4.4.3.5 Screws shall be installed at a maximum spacing of 3” on center on the longitudinal joint of elbow covers. Refer to Figure 6.

4.4.3.6 For elbow covers, the first screw shall be installed at the center of the elbow heel with subsequent screws installed working outwards from this point toward the ends of the elbow cover. A similar process shall be used to apply the screws to the throat of the elbow cover. Refer to Figure 6.

4.4.3.7 Screws shall be installed at butt joints between elbows and straight pipe jacketing to prevent gaps from forming between the jacketing sections. Refer to Figure 6.

4.4.3.8 Screws may be caulked or neoprene washers may be used to provide a more weather tight seal.

5 APPENDICES

5.1 APPENDIX A: CORROSION RESISTANT METAL COATINGS FOR UNDERLYING PIPE, VESSELS, OR EQUIPMENT

5.1.1 GENERAL NOTE Corrosion of metal pipe, vessels, and equipment under insulation, while not typically caused by the insulation, is still a significant issue that must be considered during the design of any mechanical insulation system. The propensity for corrosion is dependent on many factors including the ambient environment and the operating temperature of the metal. The recommendations below represent the general practice in the industry but are not meant to take the place of proper system design and specification by a qualified design engineer familiar with this type of construction. We recommend that the owner consult such an engineer and have them work closely with the fabricator, the contractor, and ITW to help insure a properly designed, installed, and long-lasting insulation system free of corrosion.

5.1.2 **SPECIFIC RECOMMENDATIONS**

5.1.2.1 **Stainless Steel Pipe** – All 300 series stainless steel pipe shall be coated with a corrosion inhibiting coating system such as a reactive gel or an epoxy primer at 5 mil thickness and an epoxy finish coat at 5 mil thickness if operating in a temperature range between 140°F and 300°F or if in a cycling temperature service where the service temperature is between 140° and 300°F for more than 20% of the time. Consult a coating manufacturer for appropriate coating materials and application methods based on the operating temperature range of the pipe.

5.1.2.2 **Carbon Steel Pipe** – All carbon steel pipe operating at a service temperature between 32°F and 300°F or in cycling temperature service where the service temperature is between 32°F and 300°F for more than 20% of the time shall be coated with a corrosion inhibiting coating system such as a reactive gel or at a minimum a 5 mil thick epoxy primer. For further corrosion resistance the epoxy primer should be covered with a 5 mil epoxy finish coat. Consult a coating manufacturer for appropriate coating materials and application methods for the operating temperature range of the equipment.

5.2 APPENDIX B: DETAILS

5.2.1 The following details are referenced in the text of this guideline by their Table or Figure numbers. The diagrams included in this section are representative of details used within the industry. However, they are not intended to display the only accepted method of installation but to serve more as an example of commonly used and acceptable practices.

Table 1
Aluminum Jacketing Thickness

ITW recommends that the thickness of aluminum jacketing used vary based on the outer diameter of the insulation system and the strength of the insulation per the requirements of ASTM C1729. This recommended thickness is shown in the table below. When excessive physical abuse is expected, a jacket thicker than that shown in the table may be required. A rigid insulation is defined as having a compressive strength of 15 psi or greater. A non-rigid insulation is defined as having a compressive strength of less than 15 psi.

Outer Insulation Diameter (in)	Minimum Aluminum Jacketing Thickness (in)	
	Rigid Insulation	Non-Rigid Insulation
≤8	0.016	0.016
Over 8 thru 11	0.016	0.020
Over 11 thru 24	0.016	0.024
Over 24 thru 36	0.020	0.032
>36	0.024	0.040

Table 2
Stainless Steel Jacketing Thickness

ITW recommends that the thickness of stainless steel jacketing used vary based on the outer diameter of the insulation system per the requirements of ASTM C1767 and the strength of the insulation. This recommended thickness is shown in the table below. When excessive physical abuse is expected, a jacket thicker than that shown in the table may be required. A rigid insulation is defined as having a compressive strength of 15 psi or greater. A non-rigid insulation is defined as having a compressive strength of less than 15 psi.

Outer Insulation Diameter (in)	Minimum Stainless Steel Jacketing Thickness, (in)	
	Rigid Insulation	Non-Rigid Insulation
≤8	0.010	0.010
Over 8 thru 11	0.010	0.016
Over 11 thru 24	0.010	0.020
Over 24 thru 36	0.016	0.024
>36	0.020	0.024

Table 3

90 Degree Long Radius Fitting Cover Number

NPS (in)	Nominal Insulation Thickness in mm (inches)							
	13 (1/2)	25 (1)	38/40 (1.5)	50 (2)	63/65 (2.5)	75 (3)	88/90 (3.5)	100 (4)
1/2	1*	2	5	8	12	23	15	25
3/4	1*	2	5	8	12	23	15	25
1		3	6	11	12	23	15	25
1-1/4		3	9	11	18	23	15	25
1-1/2		4	9	18	23	15	25	26
2		7	10	18	20	24	25	26
2-1/2		13	16	20	24	25	26	31
3		14	19	22	24	25	26	31
3-1/2		17	21	27	30	33	31	34*
4		17	21	27	30	33	31	34*
4-1/2		28	27	30	38	31	34*	40*
5		28	29	36	38	39	34*	40*
6		32	35	37	39	44	45	57*
7		35	37	39	44	45	57*	52*
8		41	42	43	47	49	52*	53*
9		42	43	47	49	52*	53*	
10		46	50	51*	55*	54*	Q1*	
11		50	51*	55*	56*	Q1*	Q3*	
12		48*	55*	56*	Q1*	Q3*	Q5*	
14				Q1*	Q3*	Q5*	Q7*	
15			Q1*	Q3*	Q5*	Q7*	Q9*	
16				Q5*	Q7*	Q9*		
17			Q5*	Q7*	Q9*			
18				Q9*				

*Available in aluminum only. Not available in stainless steel.
Identification numbers beginning with Q are four-piece elbows (Quads).

Table 4

45 Degree Long Radius Fitting Cover Number

NPS (in)	Nominal Insul. Thickness in mm (inches)					
	25 (1)	38/40 (1.5)	50 (2)	63/65 (2.5)	75 (3)	88/90 (3.5)
1/2	1	3	5		8	
3/4	1	3	5		8	
1	2	4	6	7	8	
1-1/4	2	5	6	7	8	9
1-1/2	3	5	7	8	9	10
2	4	6	7	8	9	10
2-1/2	5	7	8	9	10	11
3	6	7	8	9	10	11
3-1/2	7	8	9	10	11	12
4	7	8	9	10	11	12
4-1/2	8	9	10	11	12	13
5	8	9	10	11	12	13
6	9	10	11	12	13	14
7	10	11	12	13	14	15
8	11	12	13	14	15	16*
9	12	13	14	15	16*	17*
10	13	14	15	16*	17*	18*
11	14	15	16*	17*	18*	19*
12	15	16*	17*	18*	19*	20*
14	16*	17*	18*	19*	20*	21*
15	17*	18*	19*	20*	21*	22*
16	18*	19*	20*	21*	22*	
17	19*	20*	21*	22*		
18	20*	21*	22*			
19	21*	22*				
20	22*					

*Available in aluminum only. Not available in stainless steel.

Table 5

90 Degree Short Radius Fitting Cover Number

NPS (in)	Nominal Insulation Thickness in mm (inches)							
	13 (1/2)	25 (1)	38/40 (1.5)	50 (2)	63/65 (2.5)	75 (3)	88/90 (3.5)	100 (4)
1/2	1*	2	5	8	12	23	15	25
3/4	1*	2	5	8	12	23	15	25
1		3	6	11	12	23	15	25
1-1/4		3	8	11	12	23	15	25
1-1/2		5	8	12	23	15	25	26
2		6	11	18	23	15	25	26
2-1/2		9	18	23	15	25	26	31
3		10	18	20	24	25	26	31
3-1/2		16	20	24	25	26	31	
4		16	20	24	25	26	31	
4-1/2		22	24	30	33	31		
5		22	24	30	33	31		
6		27	30	33	31			
7		30	33	31				
8		38	39	44				
9		39	44					
10		44						
11								
12		49						

*Available in aluminum only. Not available in stainless steel.

Table 6

Multi-Fit Aluminum Fitting Cover Number

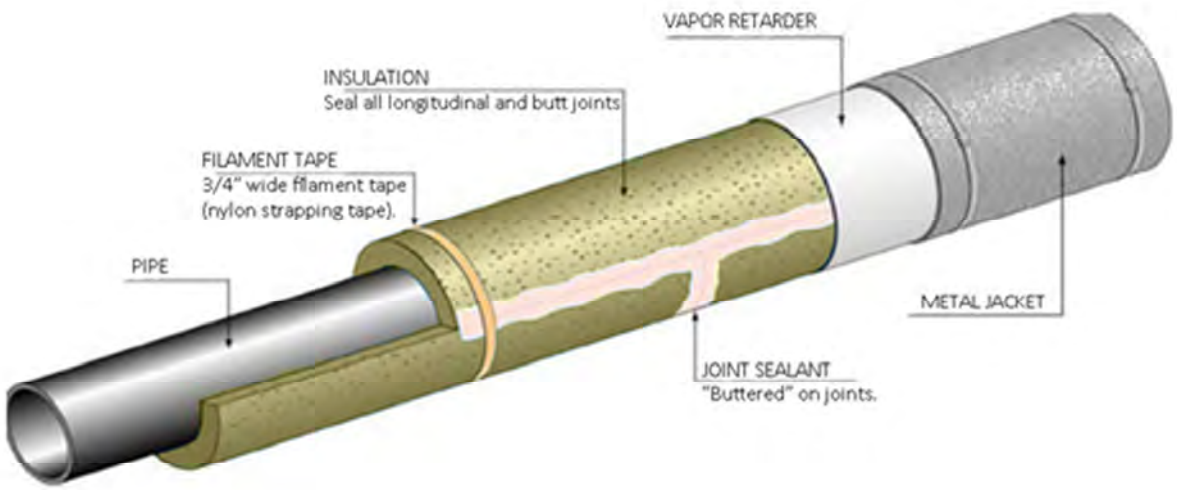
Fitting Cover Number Listed Fits
Both Long & Short Radius Elbows

NPS	Insulation Thickness (inches)								
	1	1-1/2	2	2-1/2	3	3-1/2	4	4-1/2	5
1/2	3	4	5	6	7	8	9	10	11
3/4	3	4	5	6	7	8	9	10	11
1	3-1/2	4-1/2	5-1/2	6	7	8	9	10	11
1-1/4	3-1/2	5	5-1/2	6	7	8	9	10	11
1-1/2	4	5	6	7	8	9	10	11	12
2	4-1/2	5-1/2	6	7	8	9	10	11	12
2-1/2	5	6	7	8	9	10	11	12	
3	5-1/2	6	7	8	9	10	11	12	
3-1/2	6	7	8	9	10	11	12		
4	6	7	8	9	10	11	12		
4-1/2	7	8	9	10	11	12			
5	7	8	9	10	11	12			
6	8	9	10	11	12				
7	9	10	11	12					
8	10	11	12						
9	11	12							
10	12								

Multi-Fit elbow covers are available in aluminum only and in the sizes listed above.

Figure 1

Single Layer Cold Insulation System with Vapor Retarder and Jacket

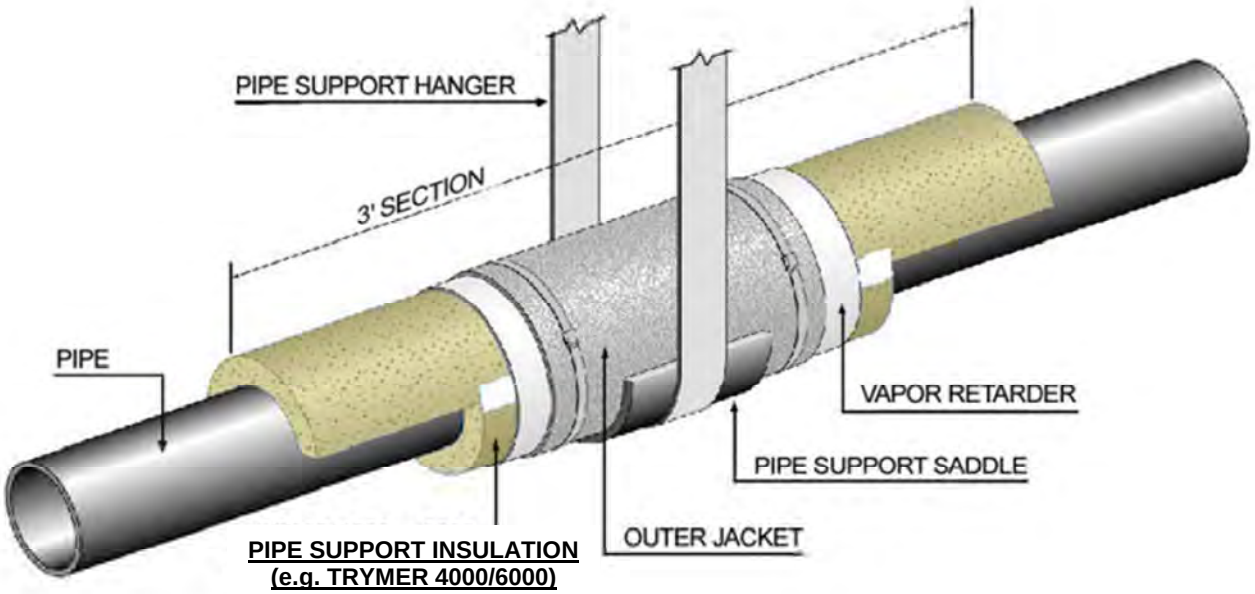


Detail Notes:

- In applications where the pipe is cold (below ambient temperature), rivets, screws, staples or any other fastener capable of penetrating the underlying vapor retarder shall NOT be used to secure the metal jacketing. Banding shall be used for this type of application.

Figure 2

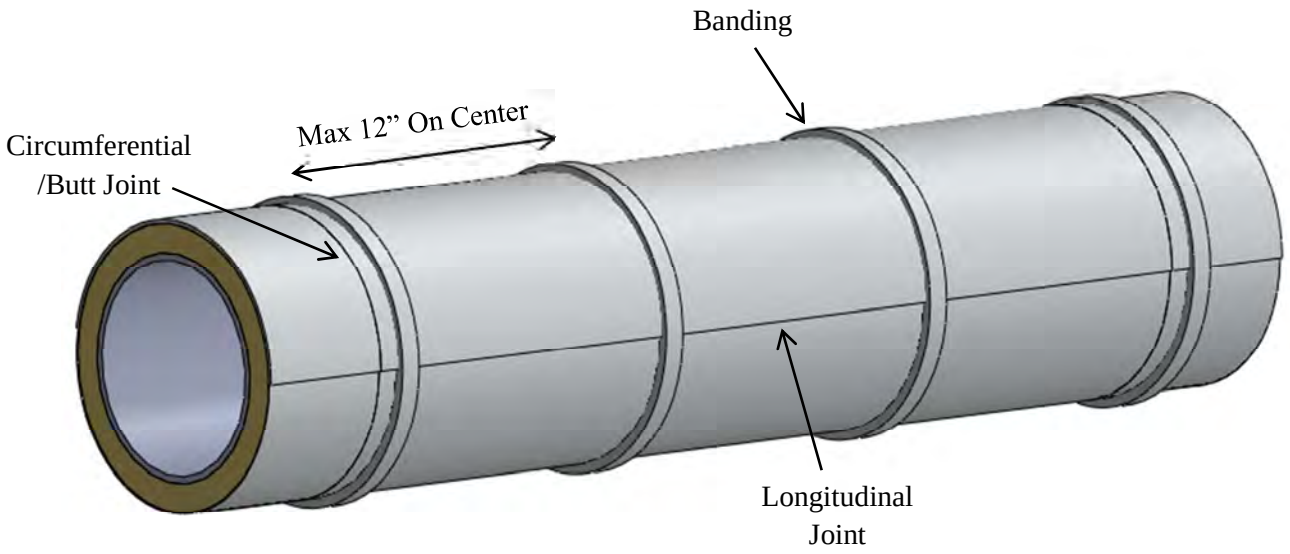
Single Layer Insulation System through Pipe Hanger Support



Detail Notes:

- Metal jacketing shall be installed in continuous fashion through the pipe support.

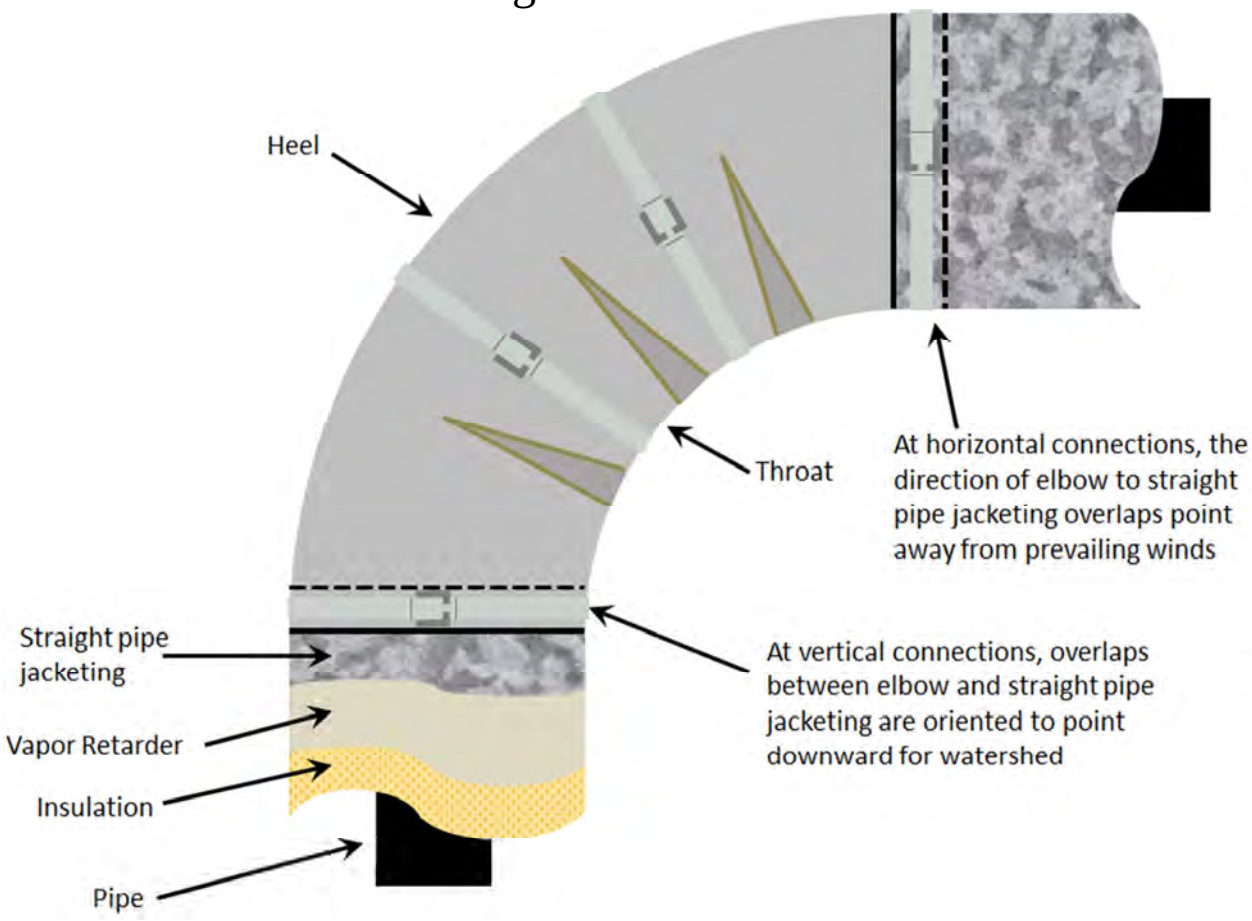
Figure 3
Banding on Straight Pipe Jacketing



Detail Notes:

- On cold systems or any system where a continuous vapor retarder is desired, banding shall be used to secure the jacketing and screws, rivets, or other fasteners capable of penetrating an underlying vapor retarder shall not be used. On hot systems or where a continuous vapor retarder is not required, banding, screws, or rivets can be used at the discretion of the contractor, owner, or specification writer. Refer to Figure 5.
- Butt/end joints shall be secured with bands and seals centered directly over joint. This includes joints between two straight sections of jacketing, where straight jacketing meets an elbow, and other circumferential joints.
- Straight sections of jacketing shall be neatly secured with bands and seals with a maximum spacing of 12" on center. For a 36" jacket section, two bands shall be installed evenly spaced between the bands over the two end joints.

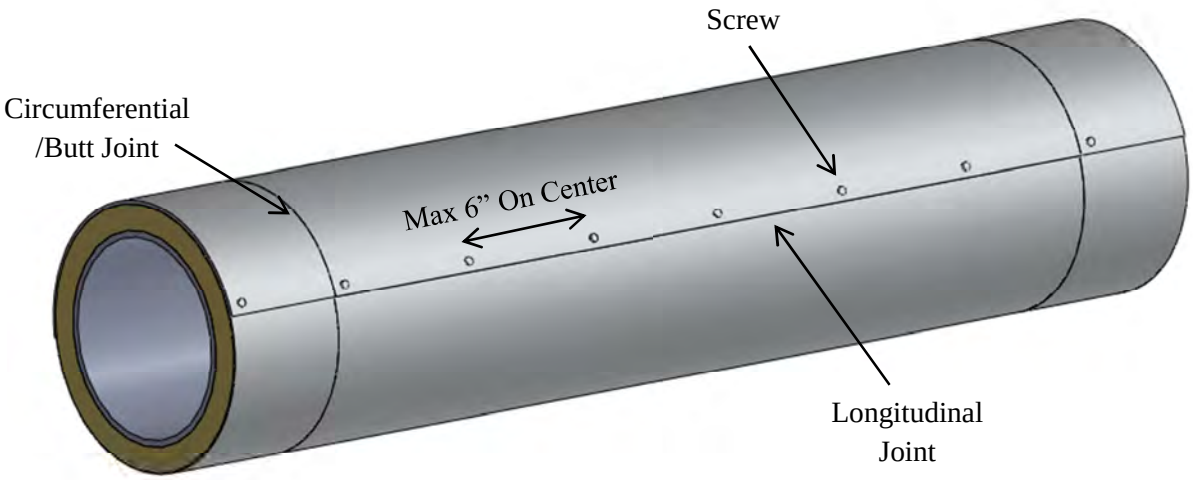
Figure 4
Banding on Elbow Covers



Detail Notes:

- On cold systems or any system where a continuous vapor retarder is desired, banding shall be used to secure the jacketing and screws, rivets, or other fasteners capable of penetrating an underlying vapor retarder shall not be used. On hot systems or where a continuous vapor retarder is not required, banding, screws, or rivets can be used at the discretion of the contractor, owner, or specification writer. Refer to Figure 5.
- In applications where the pipe is cold (below ambient temperature), rivets, screws, staples, or any other fastener capable of penetrating the underlying vapor retarder shall NOT be used to secure the metal jacketing. These types of fasteners shall only be used on systems operating at above ambient temperature that do not have a vapor retarder.
- Banding used to secure metal elbow covers shall be applied between the raised “fingers”, tightened, and secured using a wing seal. Bands shall also be applied over the butt joint overlaps with straight pipe jacketing. The number of bands required for securing elbow covers varies with size.

Figure 5
Screws/Fasteners on Straight Pipe Jacketing

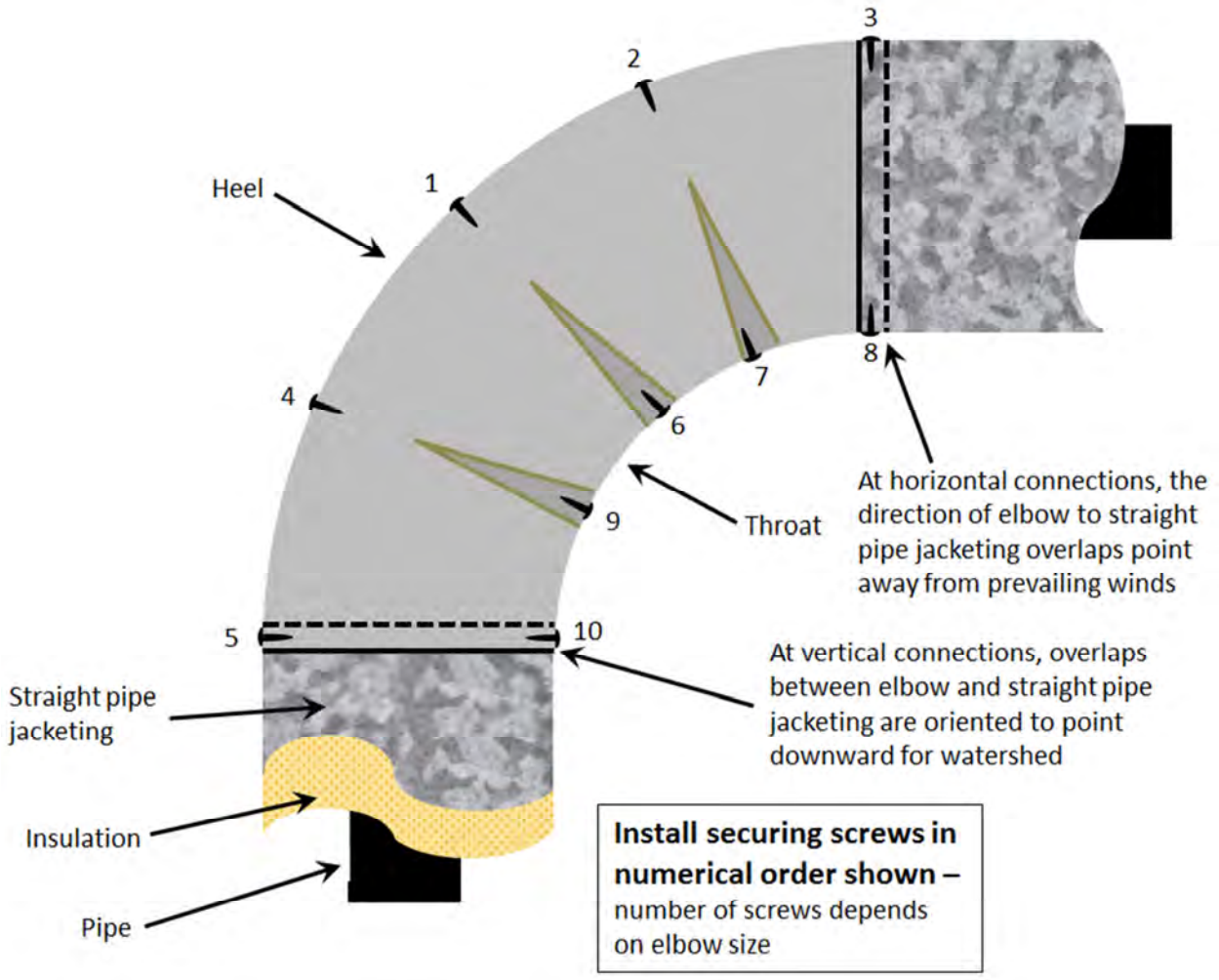


Detail Notes:

- Screws shall only be used on systems operating at above ambient temperature that do not have a vapor retarder.
- #8x½" stainless steel screws shall be used.
- Screws shall be installed along the longitudinal joints at a maximum spacing of 6" on center for straight pipe jacketing sections.

Figure 6

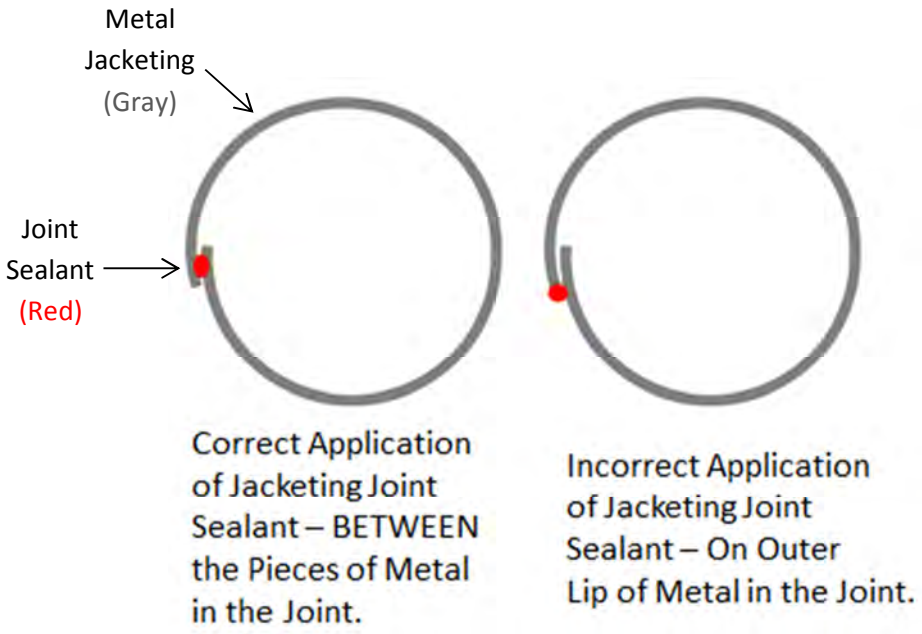
Screws/Fasteners on Elbow Covers – Hot Applications Only



Detail Notes:

- Screws shall only be used on systems operating at above ambient temperature that do not have a vapor retarder.
- #8x½" stainless steel screws shall be used.
- Screws shall be installed at a maximum spacing of 3" on center for elbow covers.
- The first screw shall be installed at the center of the elbow heel with subsequent screws installed working outwards from this point toward the ends of the elbow cover. The same process shall be used to apply the screws to the throat of the elbow cover.
- Screws shall be installed at butt joints between elbows and straight pipe jacketing to prevent gaps from forming between the jacketing sections.

Figure 7
Application of Jacketing Joint Sealant – Cross-Section View



Detail Notes:

- Jacketing sealant shall be applied in the jacketing joint between the overlapping pieces of metal and not as a bead of caulk on the exterior lip of the jacketing joint.

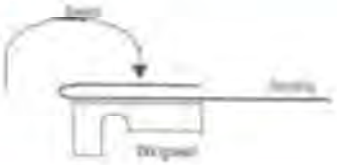
Figure 8

Attaching Banding and Wing Seals: Making and Applying Fabstraps

STEP 1

Cut your banding to the proper length. With the tips of the wingseal pointed down, thread the banding through the wingseal, extending the end about 1-1/4" inches past the seal.

STEP 2



Bend the end of the banding up 180 degrees over the wingseal so that it is flat.

STEP 3

Bend the seal back on the banding about 30 degrees.

Your Fabstrap is complete.

STEP 4

Wrap the fabstrap around the jacketed insulation, with the wingseal tips pointing up. Thread the banding through the wingseal. Pull the banding tight with a banding tool.

STEP 5

After the banding is pulled tight, bend the banding at the wingseal, up and over 180 degrees.

STEP 6

Push the tips of the wingseal down, then lightly hit them with a hammer, to lock the fabstrap into place. Trim the excess banding or bend over the top.

ALUMINUM ROLL JACKETING (cladding)

DESCRIPTION

ITW Pabco/Childers Aluminum Roll Jacketing is the premier protective outer surface for mechanical insulation systems including pipe, vessels, and equipment. It protects the insulation and underlying pipe/vessel from physical damage, UV exposure, corrosive atmospheres, and water.

ITW Aluminum Roll Jacketing (also called cladding) is available in smooth, stucco embossed, and 3/16 corrugated (cross-crimped) finishes. For larger surfaces, box-rib and deep corrugated sheets are also available.

ITW Aluminum Roll Jacketing has a bare outer surface and comes standard with a 3 mil thick polysurlyn moisture barrier heat-laminated to the interior surface to help prevent corrosion of the jacketing and the underlying metal pipe, vessel, or equipment.

COMPOSITION

Commercially pure aluminum is relatively soft and less suited for use in this application. Its strength can be greatly improved by alloying with small percentages of one or more other elements such as manganese, silicon, copper, zinc, and magnesium. Additional strength can be achieved by cold working. ITW Insulation Systems carefully screens all potential aluminum coil suppliers to assure our products have the highest quality, are corrosion resistant, and comply with all relevant standards.

ITW Aluminum Roll Jacketing is typically manufactured using alloys 3105 or 3003 which have very similar composition and performance and are considered interchangeable for use as insulation jacketing. ITW reserves the right to ship whichever alloy is in stock at the time of order placement. One of these two specific alloys or an alternative alloy can be specified by purchaser at time of order placement but this may affect minimum quantity, lead-time, and price.

Composition Differences in Aluminum Alloys (%)

Alloy	Cu	Mn	Mg	Zn
3105	≤ 0.3	0.3-0.8	0.2-0.8	≤ 0.4
3003	0.05-0.2	1-1.5	---	≤ 0.1

COMPLIANCE TO STANDARDS

Both bare and polysurlyn lined Aluminum Roll Jacketing from ITW Insulation Systems comply with the requirements of the ASTM Aluminum Jacketing Material Standard, C1729, Type I, which includes the strength and chemical composition requirements for compliance to ASTM B209 (Aluminum Alloy Standard).

RECOMMENDED USES

ITW Aluminum Roll Jacketing is recommended for use in all of the following insulation system applications:

- Standard outdoor use on all pipe and vessel insulation systems up to 8 ft outer diameter
- Indoor insulation system applications up to 8 ft outer diameter where increased damage resistance is desired

LIMITATIONS ON USE

ITW Aluminum Roll Jacketing is not appropriate for the following applications:

- For equipment and vessel insulation applications where the outer diameter is larger than 8 ft, ITW deep corrugated aluminum sheets should be used
- For rooftop refrigeration applications, painted Aluminum Jacketing should be considered
- For applications where maximum fire resistance is required, stainless steel jacketing should be used
- For applications where additional resistance to corrosion from the external environment is required, ITW painted aluminum jacketing may be used. Where maximum corrosion resistance is required, ITW stainless steel jacketing (T304 or T316) should be used.

POLYSURLYN MOISTURE BARRIER

Polysurlyn Moisture Barrier (PSMB) is an engineered three layer coextruded film of polyethylene and Surlyn* polymers with a total film thickness of 3 mils (76 µm) that is heat laminated in the factory to the interior surface of Aluminum Roll Jacketing. ITW recommends the use of PSMB on all Aluminum Roll Jacketing to help prevent pitting, crevice, and galvanic corrosion of the interior surface of the metal jacketing and the underlying insulated pipe, tank, or equipment.

Due to its superior performance characteristics, PSMB replaces the old moisture barrier technology of 1 to 3 mil thick polykraft.

PERFORMANCE REQUIREMENTS

ITW Aluminum Roll Jacketing with a 3 mil polysurlyn moisture barrier has been tested at a third party lab for flammability and emittance using the standard industry test methods. The results were:

Property	Value
ASTM E84 Flame Spread Index*	0
ASTM E84 Smoke Developed Index*	5
Outer Surface Emittance	0.1

*Tested with exterior metal surface exposed to the flame

SURFACE FINISHES

Each of the three surface finishes available for ITW Aluminum Roll Jacketing (smooth, stucco embossed, and 3/16" corrugated) has applications where it is recommended. All of these can be supplied with a painted exterior. For more information on this, consult the ITW data sheet on painted Aluminum Roll Jacketing.

Smooth (Plain Mill) Finish
This is a very popular finish and is the "default" for the many end-users/specifiers who prefer the clean look of this finish. This finish sheds rain water the best. However, this smooth surface readily shows damage such as from hail or other physical abuse. It also shows the dirt more than the other finishes due to its smoothness. Lastly, it is highly reflective of sunlight and when located near roadways, some specifiers see this reflection as a possible concern.

Stucco Embossed Finish
This is another popular finish used for ITW Aluminum Roll Jacketing. The stucco-like surface texture hides small imperfections and scratches caused by physical damage during or after installation. This finish also reduces reflectivity while still looking very professional. Lastly, the use of stucco embossed finish provides a small increase to the rigidity and strength of the ITW Aluminum Roll Jacketing.

3/16" Corrugated (Cross-Crimped) Finish
This finish consists of parallel grooves or crimps about 3/16" apart running in the length direction of the pipe. This finish also hides small damage and scratches to the jacketing and reduces sunlight reflection. In addition, the nature of this finish gives the aluminum jacket more ability to expand and contract to adapt to insulation movement caused by pipe or ambient temperature changes. Lastly, the rigidity and strength of 3/16" corrugated finish is substantially increased making it ideal for use as jacketing on large diameter pipe and vessels up to 8 ft diameter. This finish is available in a maximum thickness of 0.024 inches.

RECOMMENDED THICKNESS

ITW recommends that the thickness of Aluminum Roll Jacketing used vary based on the outer diameter of the insulation system per the requirements of ASTM C1729. This recommended thickness is shown in the table below.

Outer Insulation Diameter (in)	Minimum Aluminum Jacket Thickness, inches (mm)	
	Rigid Insulation	Non-Rigid Insulation
≤ 8	0.016 (0.4)	0.016 (0.4)
Over 8 thru 11	0.016 (0.4)	0.020 (0.5)
Over 11 thru 24	0.016 (0.4)	0.024 (0.6)
Over 24 thru 36	0.020 (0.5)	0.032 (0.8)
>36	0.024 (0.6)	0.040 (1.0)

Series 1000DCV, 1005DCV, 1010DCV

Detector Check Valves

Sizes: 4" – 10" (100 – 250mm)

Features

- Fabricated steel body provides a much lighter weight unit than cast steel or ductile iron
- Approved for mounting in horizontal or vertical positions
- Prevents backflow from fire prevention systems
- Used to isolate fire systems from public main during pumper boost of fire system
- Ames-Guard™ epoxy coating is rust resistant and impervious to most chemicals

1000DCV

1010DCV

1005DCV

Available Models

1000DCV – 4"-10" (100-250mm)
125# flanged end connections

1005DCV – 4"-6" (100-150mm)
125# flanged x grooved end connections

1010DCV – 4"-6" (100-150mm) grooved x grooved end connections

with bypass specify suffix:

CFM – cubic feet per minute meter

GPM – gallons per minute meter

LM – without meter

Standard units are less bypass

Materials

Body: fabricated steel

Knuckle Joint Assembly: stainless steel linkage

Seat: Bronze ASTM B63-82

Pressure – Temperature

Maximum Working Pressure: 175psi (12.1 bar)

Temperature Range: 33˚F – 110°F (0.5˚C – 43°C)

Series 1000DCV Detector Check Valves detect any leakage or unauthorized use of water from fire or automatic sprinkler systems. Series 1000DCV are designed to protect drinking water supplies from dangerous cross-connections in accordance with national plumbing codes and water authority requirements for non-potable service applications such as irrigation, fire line, or industrial processing. During times of minimal water flow, the valve clapper remains closed so that the water flows through a bypass meter (optional). When fire flow is required, the water demand will open the clapper to allow full water flow.

Specifications

A Detector Check Valve shall be installed on fire protection or automatic sprinkler systems when connected to the potable water supply. The valve body shall be formed, welded units, in heavy steel. The valve shall be hydrostatically tested in excess of 700psi (48 bar). Valve construction shall eliminate any possibility of defects such as sand pits and blow holes which may occur in casting. All linkage parts shall be stainless steel. The removable clapper seat ring should be bronze. Each valve shall be individually tested before shipping. Valves shall be fusion bonded epoxy coated in accordance with AWWA C550. Valve shall be an Ames Fire & Waterworks Series 1000DCV.

Job Name _____ Contractor _____

Job Location _____ Approval _____

Engineer _____ Contractor's P.O. No. _____

Approval _____ Representative _____

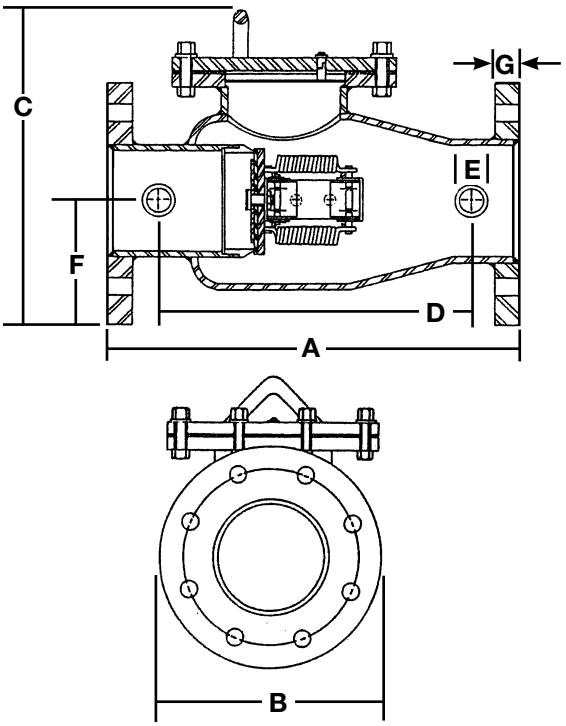
Approvals

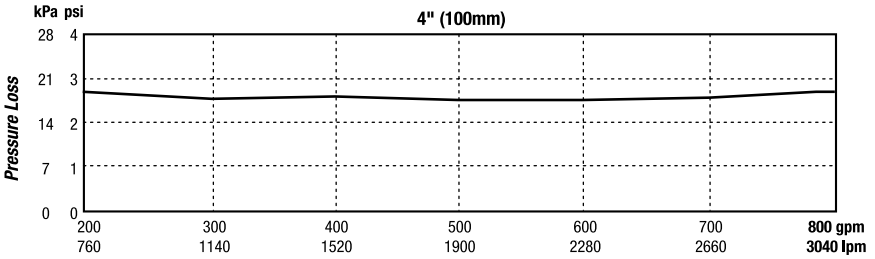
Listed FM Approved

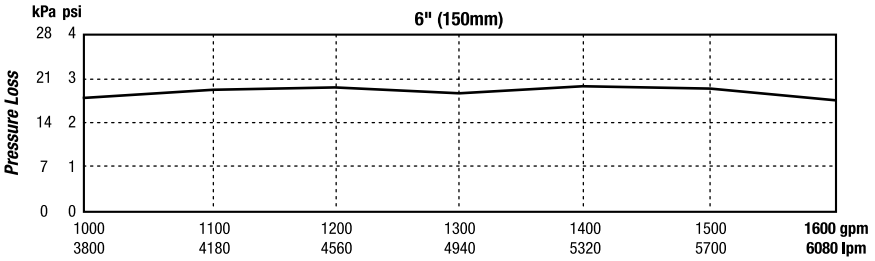
Flange bolt pattern and hole diameter in accordance with ANSI B16.5 Class 125/AWWA C207 Class D

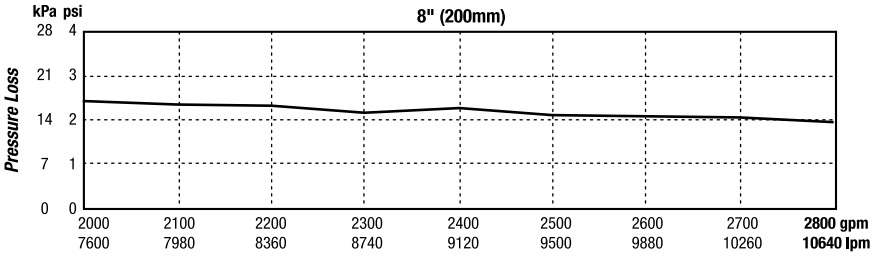
Body nameplate provides nominal size, direction of flow, PSI rating, year of manufacture and approval marks

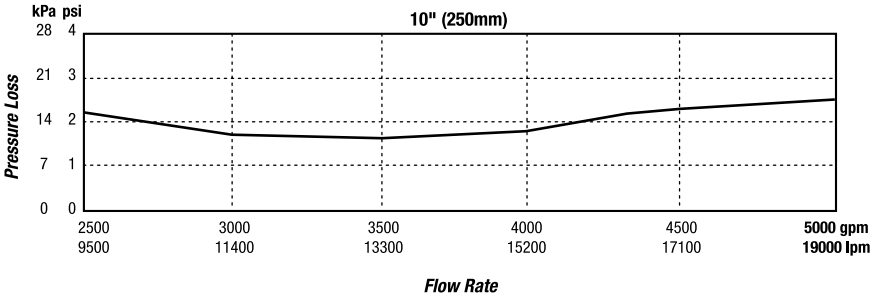
Dimensions – Weights











SIZE (DN)		DIMENSIONS														WEIGHT	
		A		B		C		D		E		F		G			
in.	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*in.*	*mm*	*lb.*	*kg*
4	100	16½	419	9	229	12½	318	12⅛	308	1 NPT	25	4½	114	5⁄8	16	60	27
6	150	22½	559	11	279	15⅛	384	17	432	1½ NPT	38	5½	140	11⁄16	17	96	74
8	200	26½	665	13½	343	17¾	450	21	533	2 NPT	51	6¾	171	11⁄16	17	154	70
10	250	36	914	16	406	21	533	28	711	2 NPT	51	8	203	11⁄16	17	179	81

Consult factory for 1005DCV and 1010DCV dimensions.

⚠ WARNING

It is illegal to use this product in any plumbing system providing water for human consumption, such as drinking or dishwashing, in the United States. Before installing standard material product, consult your local water authority, building and plumbing codes.

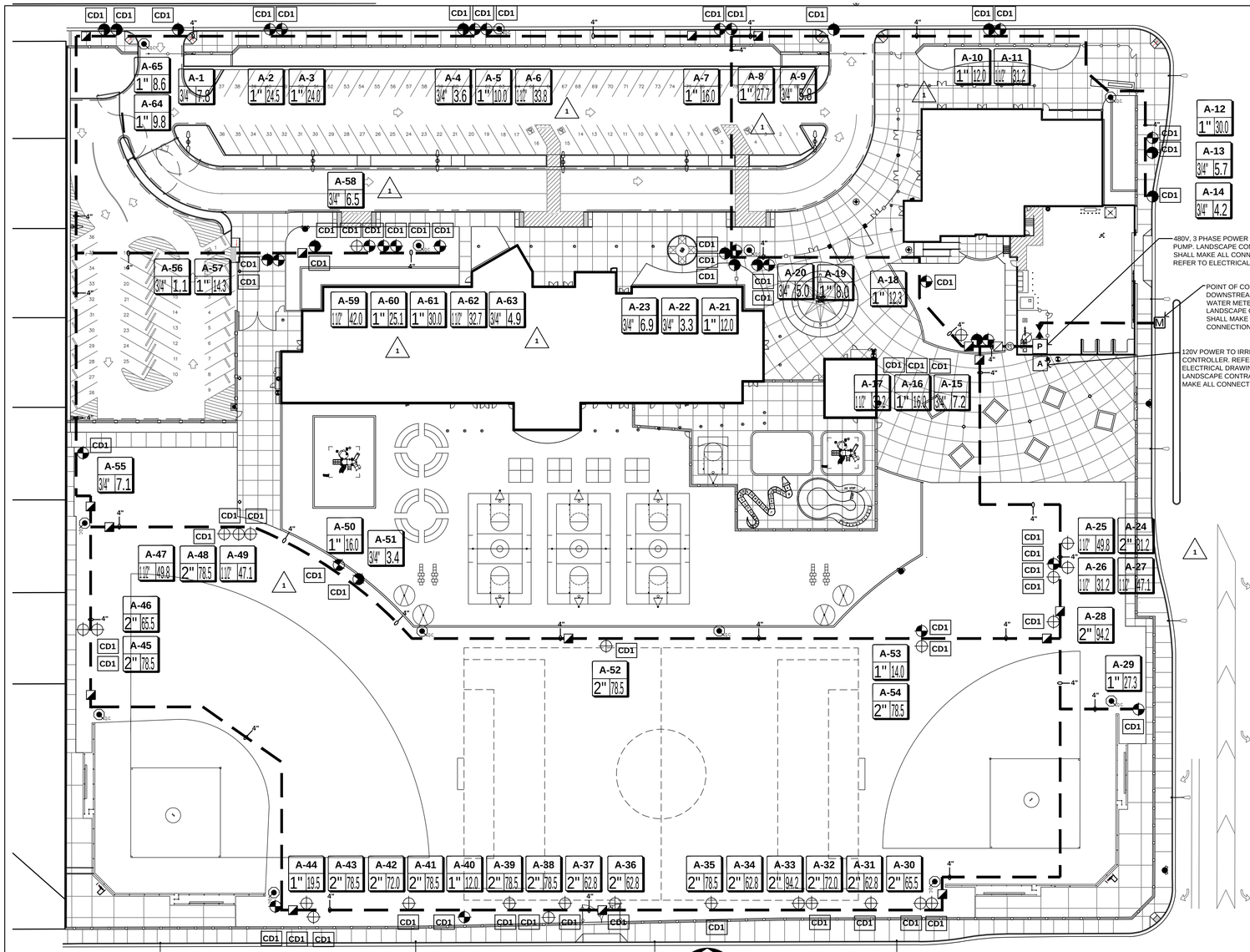
NOTICE

Inquire with governing authorities for local installation requirements

AMES FIRE & WATERWORKS

A Watts Water Technologies Company

USA: Backflow Tel: (978) 689-6066 • Fax: (978) 975-8350 • AmesFireWater.com
USA: Control Valves Tel: (713) 943-0688 • Fax: (713) 944-9445 • AmesFireWater.com
Canada: Tel: (905) 332-4090 • Fax: (905) 332-7068 • AmesFireWater.ca
Latin America: Tel: (52) 81-1001-8600 • Fax: (52) 81-8000-7091 • AmesFireWater.com



OVERALL IRRIGATION PLAN

1" = 40'-0"

IRRIGATION LEGEND

SYM.	MANUFACTURER & DESCRIPTION	NOZZLE	GPM/ PSI	DETAIL
	HUNTER I-25-06-SS-R POP-UP ROTOR W/ STANDARD NOZZLE.	18	15.7 @ 60 PSI	G / LS.5.0
	HUNTER I-25-06-SS-R POP-UP ROTOR W/ STANDARD NOZZLE.	18	15.7 @ 60 PSI	G / LS.5.0
	HUNTER I-25-06-SS-R POP-UP ROTOR W/ STANDARD NOZZLE.	8	9.2 @ 60 PSI	G / LS.5.0
	HUNTER I-20-06-SS-R POP-UP ROTOR W/ GRAY LOW ANGLE NOZZLE.	4.5 LA	4.4 @ 50 PSI	G / LS.5.0
	HUNTER I-20-06-SS-R POP-UP ROTOR W/ GRAY LOW ANGLE NOZZLE.	4.5 LA	4.4 @ 50 PSI	G / LS.5.0
	HUNTER I-20-06-SS-R POP-UP ROTOR W/ GRAY LOW ANGLE NOZZLE.	2.5 LA	2.8 @ 50 PSI	G / LS.5.0
	HUNTER I-20-06-SS-R POP-UP ROTOR W/ BLUE STANDARD NOZZLE	8.0	8.0 @ 45 PSI	G / LS.5.0
	HUNTER I-20-06-SS-R POP-UP ROTOR W/ BLUE STANDARD NOZZLE	8.0	8.0 @ 45 PSI	G / LS.5.0
	HUNTER I-20-06-SS-R POP-UP ROTOR W/ BLUE STANDARD NOZZLE	4.0	4.0 @ 45 PSI	G / LS.5.0
	RAINBIRD 1806-SAM-PRS-1800-NPCAP 6" POP-UP SPRAY W/ 'U' SERIES NOZZLE	12'-F,H,Q	2.60, 1.30, 0.65 @ 30 PSI	F / LS.5.0
	RAINBIRD 1806-SAM-PRS-1800-NPCAP 6" POP-UP SPRAY W/ 'U' SERIES NOZZLE	10'-F,H,Q	1.64, 0.82, 0.41 @ 30 PSI	F / LS.5.0
	RAINBIRD 1806-SAM-PRS-1800-NPCAP 6" POP-UP SPRAY W/ 'U' SERIES NOZZLE	8'-F,H,Q	1.05, 0.52, 0.26 @ 30 PSI	F / LS.5.0
	RAINBIRD 1804-SAM-PRS-1800-NPCAP 4" POP-UP SPRAY W/ 'U' SERIES NOZZLE	15'-F,H,Q	3.70, 1.85, 0.92 @ 30 PSI	F / LS.5.0
	RAINBIRD 1804-SAM-PRS-1800-NPCAP 4" POP-UP SPRAY W/ 'U' SERIES NOZZLE	12'-F,H,Q	2.60, 1.30, 0.65 @ 30 PSI	F / LS.5.0
	RAINBIRD 1804-SAM-PRS-1800-NPCAP 4" POP-UP SPRAY W/ 'U' SERIES NOZZLE	10'-F,H,Q	1.64, 0.82, 0.41 @ 30 PSI	F / LS.5.0
	RAINBIRD 1806-SAM-PRS-1800-NPCAP 6" POP-UP SPRAY W/ ADJUSTABLE FLOOD BUBBLER NOZZLE.	1300 A-F	1.70 @ 30 PSI	F / LS.5.0
	RAINBIRD RWS-B-1404-SOCK-GRATE-P ROOT WATERING SYSTEM.	1404	1.0 @ 30 PSI	E / LS.5.0
	FEBCO 4" 880LF REDUCED PRESSURE BACKFLOW PREVENTER. PROVIDE VALVE SETTER.			A / LS.5.1
	NIBCO F-619-RW-SON CAST IRON RESILIENT WEDGE GATE VALVE W/ 2" OPERATING NUT. SIZE EQUAL TO MAINLINE.			C / LS.5.0
	RAINBIRD 44NP QUICK COUPLING VALVE. INSTALL IN VALVE BOX.			D / LS.5.0
	TORO P-220S-26-9 SERIES ELECTRIC CONTROL VALVE W/ FLOW CONTROL, EFF-KIT-60HZ & TORO DCLS-P LATCHING SOLENOID & TORO CDEC DECODER. SIZE AS NOTED ON PLAN. MAKE CONNECTIONS PER TORO SPECIFICATIONS.			A / LS.5.0
	TORO P-220S-27-9 SERIES ELECTRIC CONTROL VALVE W/ EZR-100 EZ-REG PRESSURE REGULATOR MODULE, FLOW CONTROL, EFF-KIT-60HZ & TORO DCLS-P LATCHING SOLENOID & TORO CDEC DECODER. SIZE AS NOTED ON PLAN. MAKE CONNECTIONS PER TORO SPECIFICATIONS.			A / LS.5.0
	IRRITROL 700 SERIES CONTROL VALVE W/ OMR-100 OMNI REG PRESSURE REGULATOR & TORO DCL-P LATCHING SOLENOID, RW60-KIT & TORO CDEC DECODER. SIZE AS NOTED.			A / LS.5.0
A	TORO TDC CDEC-PED-100 TWO WIRE IRRIGATION CONTROLLER.INSTALL IN STAINLESS STEEL PEDESTAL W/ DISCONNECT SWITCH. CONTROLLER SHALL BE REMOTE READY. PROVIDE & INSTALL TORO TWRS/TWRFS WIRELESS RAIN/FREEZE SENSOR. MOUNT TRANSMITTER TO ROOF EAVE IN APPROVED LOCATION/MANNER. MOUNT RECEIVER TO CONTROLLER ENCLOSURE IN APPROVED MANNER. PROVIDE 3/4" CONDUIT W/ CAT/5 ETHERNET CABLE TO CONTROLLER FROM NEAREST IDF BOARD.			L / LS.5.0
P	WATERTRONICS WMBV-5000-2-15-460-3-300-80 SKID MOUNTED BOOSTER PUMP W/ VFD CONTROLS & PUMP START PANEL. MAKE ALL CONNECTIONS. PROVIDE RELAY, DECODER & WIRE TO PUMP START IN CONTROLLER 'A'.			J / LS.5.1
	NIBCO F-619-RW-SON RESILIENT WEDGE BLOW OFF VALVE W/ 2" OPERATING NUT. INSTALL IN VALVE BOX.			B / LS.5.0
	CLASS 200 'O' RING GASKETED 'PURPLE TINTED' NON POTABLE PVC MAIN LINE, SEE PLAN FOR SIZE.			H / LS.5.0
	CLASS 200 'PURPLE TINTED' NON POTABLE PVC LATERAL LINE, SEE PLAN FOR SIZE			H / LS.5.0
	TORO DL2000 RGP-412 DRIPLINE. INSTALL ON FINISH GRADE OF DIRT AT 12" O.C. STAPLE IN PLACE AT 12" O.C.			B / LS.5.1
	SCH. 40 PVC SLEEVE, SEE LEGEND FOR SIZE			H / LS.5.0
	EZ-FLO FERTIGATION SYSTEM EZ025-HC. INSTALL IN VALVE BOX W/ CBV-400 4" COUPLING BALL VALVE CONNECTION			I / LS.5.1
A	TORO T-YD-500-34 AIR RELIEF VALVE. INSTALL IN VALVE BOX.			O / LS.5.0
P	TORO T-FCH-H-FIPT FLUSH VALVE. INSTALL IN VALVE BOX.			P / LS.5.0
	TORO T-ALFS 75150-S Y FILTER W/ 150 MESH STAINLESS STEEL SCREEN.			A / LS.5.0 SIM.
CD1	TORO CDEC-ISP-1 SINGLE STATION DECODER WITH SURGE SUPPRESSION. INSTALL IN VALVE BOX. MAKE ALL WIRE CONNECTIONS PER MANUFACTURER'S RECOMMENDATIONS. PROVIDE (1) DEC-SG-LINE LINE SURGE PROTECTOR AT 1,400 L.F. O.C. W/ GROUNDING ROD.			A / LS.5.0
	BERMAD 4" 410 MASTER VALVE W/ FLANGED ENDS. NORMALLY OPEN. PROVIDE 24V DC LATCHING SOLENOID & RELAY/DECODER. INSTALL IN VALVE BOX.			A / LS.5.0 SIM.
FS	FLOMEC QS 200-300 3" FLOW SENSOR. INSTALL IN VALVE BOX.			K / LS.5.1

VALVE KEY

A-2 1" 75.5

- CONTROLLER STATION ID
- GALLONS PER MINUTE
- VALVE SIZE

IRRIGATION SLEEVE LEGEND

KEY	DESCRIPTION
1	(1) 8" PVC MAINLINE SLEEVE
2	(1) 3" PVC LATERAL SLEEVE
3	(1) 4" PVC LATERAL SLEEVE

IRRIGATION NOTES

1. LATERAL LINES SHALL BE CLASS 200 PVC.
2. ADJUST ALL IRRIGATION HEADS TO ELIMINATE OVERSPRAY ON ADJACENT HARD SURFACE AREAS. PROVIDE ADJUSTABLE ARC NOZZLE FOR IRRIGATION HEADS WHERE OVERSPRAY IS EXCESSIVE. PROVIDE CHECK VALVES WHERE NEEDED TO PREVENT LOW HEAD DRAINAGE
3. PIPING, VALVES, ETC. SHOWN WITHIN PAVED AREAS ARE FOR DESIGN CLARIFICATION ONLY AND SHALL BE INSTALLED IN PLANTING AREAS WHERE POSSIBLE.
4. IRRIGATION SYSTEM DESIGN: 300 G.P.M. @ 80 PSI AT POINT OF CONNECTION.
   55 PSI PROVIDED AT STREET CONNECTION
   43 PSI BOOST PROVIDED BY PUMP
5. DO NOT WILLFULLY INSTALL THE IRRIGATION SYSTEM AS SHOWN ON THE DRAWINGS WHEN IT IS OBVIOUS IN THE FIELD THAT OBSTRUCTIONS, GRADE DIFFERENCES OR DIFFERENCES IN THE AREA DIMENSIONS EXIST THAT MIGHT NOT HAVE BEEN CONSIDERED IN THE ENGINEERING. SUCH OBSTRUCTIONS OR DIFFERENCES SHOULD BE BROUGHT TO THE ATTENTION OF THE LANDSCAPE ARCHITECT. IN THE EVENT THIS NOTIFICATION IS NOT PERFORMED, THE CONTRACTOR SHALL ASSUME FULL RESPONSIBILITY FOR ANY REVISIONS NECESSARY AT NO EXPENSE TO THE OWNER.
6. SPLICING OF 24 VOLT WIRES WILL NOT BE PERMITTED EXCEPT IN VALVE BOXES. LEAVE A 24" COIL OF EXCESS WIRE AT EACH SPLICE. LABEL ALL WIRES W/ WATERPROOF MARKERS AT ALL SPLICES, VALVE MANIFOLDS AND CONTROLLER.
7. INSTALL VALVE BOXES 12" FROM AND PERPENDICULAR TO WALKS, CURB, LAWN, BUILDINGS OR LANDSCAPE FEATURES. AT MULTIPLE VALVE BOX GROUPS, EACH BOX SHALL BE AN EQUAL DISTANCE FROM THE WALK, CURB, LAWN, ETC. AND EACH BOX SHALL BE 6" APART. SHORT SIDE OF THE VALVE BOX SHALL BE PARALLEL TO WALK, CURB, LAWN ETC. INSTALL ONE VALVE PER BOX ONLY.
8. CONTRACTOR SHALL BE RESPONSIBLE FOR THE INSTALLATION OF ALL MATERIAL APPEARING ON PLAN.
9. CONCRETE THRUST BLOCKS SHALL BE PROVIDED ON ALL MAINLINE PIPING. THEY ARE TO BE LOCATED AT ALL ABRUPT CHANGES IN PIPELINE GRADE, CHANGES TO HORIZONTAL ALIGNMENT, REDUCTION IN PIPE SIZES, END OF LINE AND IN-LINE VALVES TO ABSORB ANY AXIAL THRUST OF THE PIPE. THE PIPE MANUFACTURE'S RECOMMENDATIONS FOR THRUST BLOCKS MUST BE FORMED AGAINST UNDISTURBED EARTH.
10. ALL MAIN LINE PIPES SHALL BE PRESSURE TESTED PER STANDARD IRRIGATION SPECIFICATIONS WITH THE VALVES INSTALLED. THE CONTRACTOR SHALL PROVIDE ALL EQUIPMENT NEEDED. IF ANY LEAKS DEVELOP, THE REPAIRS ARE TO BE MADE AND TEST REPEATED UNTIL THE SYSTEM IS PROVEN WATERTIGHT. THE CONTRACTOR IS TO CENTER LOAD THE PIPE AND LEAVE ALL JOINTS EXPOSED FOR INSPECTION. THE PRESSURE TEST SHALL BE OBSERVED AND APPROVED BY THE INSPECTOR. WHEN THE PIPE IS PROVEN WATERTIGHT AND ONLY THEN MAY THE LINE BE BACKFILLED.
11. THE CONTRACTOR SHALL PROVIDE AND KEEP AN UP-TO-DATE "RECORD DRAWING" SHOWING ALL CHANGES TO THE ORIGINAL DRAWINGS AND EXACT LOCATIONS OF FACILITIES INSTALLED. BEFORE FINAL INSPECTION, THE CONTRACTOR SHALL FURNISH "RECORD DRAWINGS" TO THE PROJECT INSPECTOR.
12. CONTRACTOR SHALL PROVIDE TO THE DISTRICT THE FOLLOWING EQUIPMENT AS PART OF HIS WORK:

    ONE (1) TORO TMR-1-KIT REMOTE RADIO TRANSMITTER, RECEIVER, BATTERY AND ANTENNA

    FOUR (4) COMPLETE ASSEMBLIES OF RAINBIRD 44NP QUICK COUPLER KEY WITH SWIVEL HOSE ELBOW.

    TWO (2) GATE VALVE KEY FOR 2" OPERATING NUT.

    IRRIGATION REPLACEMENT EQUIPMENT.

    A. TWELVE (12) HUNTER I-25-06-NP ROTORS
    B. TWELVE (12) HUNTER I-20-06-NP ROTORS
    C. TWELVE (12) RAINBIRD 1806-SAM-PRS-1800-NPCAP POP-UP SPRAY BODIES
    D. TWELVE (12) EACH RAINBIRD 'U' SERIES NOZZLE: 12'.
    E. TWELVE (12) EACH RAINBIRD 'U' SERIES NOZZLE: 15'.

    FERTILIZER FOR FERTILIZER INJECTOR.

    A. EIGHT (8) TWENTY-FIVE (25) POUND BAGS FERTA-MAXX-COOL
    B. TWENTY-FOUR (24) TWENTY-FIVE (25) POUND BAGS FERTA-MAXX-LANDSCAPE
    C. SIXTEEN (16) TWENTY-FIVE (25) POUND BAGS FERTA-MAXX-STARTER
    D. EZ FLO EZ-FNLHC LARGE CAPACITY FILL FUNNEL

    TWO (2) SITE SERVICE CALLS WITHIN THE FIRST CALENDAR / WARRANTY YEAR FOR THE WATERTONICS IRRIGATION BOOSTER PUMP
13. ALL IRRIGATION CONTROL WIRE SHALL BE INSTALLED IN 1" SCHEDULE 40 PVC ELECTRICAL CONDUIT BELOW GRADE. PROVIDE LONG RADIUS ELBOW AT ALL TURNS AND SWEEPS INTO VALVE BOXES. PROVIDE AND INSTALL TORO TWO WIRE DECODER CABLE / CONTROL WIRE IN CONDUIT. INSTALLATION SHALL MEET MANUFACTURER'S RECOMMENDATIONS & REQUIREMENTS. PROVIDE AND INSTALL GROUNDING ROD / LINE SURGE PROTECTION AT 1,400 L.F. O.C. PER MANUFACTURER'S RECOMMENDATIONS & REQUIREMENTS. ENSURE GROUNDING & SURGE SUPPRESSION INSTALLATION MEETS MANUFACTURER'S REQUIREMENTS.
14. THE CONTRACTOR SHALL PROVIDE ONE CONTROLLER CHART FOR EACH CONTROLLER INSTALLED. THE CHART SHALL SHOW THE AREA IRRIGATED BY THE CONTROLLER AND SHALL BE THE MAXIMUM SIZE THE CONTROLLER DOOR WILL ALLOW. THE CHART MAY BE REDUCED DRAWING OF THE RECORD DRAWINGS. THE CHART SHALL BE COLORED WITH A DIFFERENT COLOR FOR EACH STATION. THE CHART SHALL BE LAMINATED OR COVERED IN A WATERTIGHT ENVELOPE.
15. THE CONTRACTOR SHALL PROVIDE TWO (2) INDIVIDUALLY BOUND SETS OF OPERATION AND MAINTENANCE MANUALS. REFER TO SPECIFICATION SECTION 32 84 00 FOR INFORMATION REQUIREMENTS.
16. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR PROVIDING A COMPLETE, FUNCTIONING IRRIGATION SYSTEM AS DIRECTED BY THE OWNER. CONTRACTOR SHALL FURNISH ALL APPURTENANT ITEMS, MATERIALS, LABOR, EQUIPMENT NECESSARY TO PROVIDE A COMPLETELY FUNCTIONAL IRRIGATION SYSTEM WHETHER SOLELY SHOWN OR CALLED FOR ON PLANS & SPECIFICATIONS. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO INCLUDE SUCH ITEMS IN THEIR PRICE FOR THE WORK. NO ADDITIONAL COMPENSATION WILL BE AUTHORIZED FOR WORK DEEMED INCLUDED IN THE CONTRACT BY OWNER.
17. CONTRACTOR IS RESPONSIBLE FOR BACKFLOW UNIT TO BE TESTED AND CERTIFIED BY AN APPROVED TESTER.
18. THE CONTRACTOR SHALL PROVIDE & INSTALL TWO (2) AIR RELEASE VALVES PER DETAIL 'M/LS.5.0' AT HIGH POINTS AND END RUNS OF MAINLINE. LOCATION SHALL BE DETERMINED IN THE FIELD BY THE LANDSCAPE ARCHITECT.
19. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR; CONTROL WIRE TERMINATION AT CONTROLLER, SCHEDULING WATER TIMES & PROGRAMS FOR THE IRRIGATION CONTROLLERS ON SITE, PROVIDING THE CORRECT AMOUNT OF WATER AFFORDED TO THE PLANT MATERIAL ON THE PROJECT FOR OPTIMUM GROWTH. CONTRACTOR SHALL PROGRAM ALL CONTROLLERS TO UTILIZE THE TOTAL DESIGN FLOW OF THE IRRIGATION SYSTEM. PROGRAMMING SHALL ATTEMPT TO BALANCE THE FLOW AT 300 GPM BY USING ALL CONTROLLERS ON SITE. THIS REQUIREMENT SHALL RUN FROM START OF CONTRACT UNTIL FINAL ACCEPTANCE OF IRRIGATION SYSTEM. NO ADDITIONAL COMPENSATION SHALL BE AUTHORIZED FOR WORK NEEDED TO: PROGRAM, SCHEDULE OR TO SET UP WATERING CYCLES DEEMED INCLUDED IN THE CONTRACT BY THE OWNER.
20. THE CONTRACTOR SHALL PROVIDE AN IRRIGATION SCHEDULE AS PART OF THE CONTRACT WORK. THE SCHEDULE SHALL COMPLY WITH THE STATE OF CALIFORNIA MODEL WATER EFFICIENT LANDSCAPE ORDINANCE.
21. THE CONTRACTOR SHALL PROVIDE A LANDSCAPE & IRRIGATION MAINTENANCE SCHEDULE AND AN IRRIGATION AUDIT, SURVEY, & IRRIGATION WATER USE ANALYSIS AS PART OF THE CONTRACT WORK. THE MAINTENANCE SCHEDULE, IRRIGATION AUDIT, SURVEY, & IRRIGATION WATER USE ANALYSIS SHALL COMPLY WITH THE STATE OF CALIFORNIA MODEL WATER EFFICIENT LANDSCAPE ORDINANCE.
22. CONTRACTOR SHALL ARRANGE AND ATTEND A PRE-CONSTRUCTION MEETING WITH THE TORO COMPANY FOR THE IRRIGATION CONTROLLER TWO WIRE SYSTEM PRIOR TO BEGINNING ANY IRRIGATION WORK ON THE PROJECT SITE. SUBMIT DOCUMENTATION AND VERIFICATION OF PRE-CONSTRUCTION MEETING FROM THE TORO COMPANY FOR REVIEW.
23. ALL NON-GALVANIZED PIPE AND FITTING SHALL BE PRIMED AND PAINTED WITH ONE COAT PRIMER AND TWO COATS COLOR WITH APPROVED TYPE RUST INHIBITIVE PRIMER AND PAINT. COLOR SHALL BE DETERMINED BY THE LANDSCAPE ARCHITECT.
23. THE CONTRACTOR SHALL PROVIDE & INSTALL THE FIRST FILL OF FERTILIZERS FOR THE EZ-FLO FERTIGATION SYSTEM TANK. PROVIDE 600 POUNDS OF FERTILIZER MATERIAL AND LABOR TO INSTALL FERTILIZER AS RECOMMENDED BY THE MANUFACTURER. FERTILIZER SHALL BE PER THE MANUFACTURER'S RECOMMENDATION AS APPROVED BY THE DISTRICT.

ROBERT BORO
LANDSCAPE ARCHITECT
P.O. Box 4734
Fresno, California 93744
TEL. (559) 266-4367
FAX (559) 266-3005

REGISTERED LANDSCAPE ARCHITECT ROBERT L. BORO, C-7811 EXP. 4/30/25 STATE OF CALIFORNIA

SIMPBK
7790 NORTH PALM AVENUE
FRESNO, CALIFORNIA 93711
T559.448.8400 - F559.448.8467
www.sim-pbk.com

PROJECT:

SHIELDS & BRAWLEY ELEMENTARY SCHOOL

CENTRAL UNIFIED SCHOOL DISTRICT — Every Child, Every Chance, Every Day!

AD 5-39a
S&B Elementary
02-116800

JOHN H. SMITH, A.I.A. C15885

LICENSED ARCHITECT JOHN HAMILTON SMITH C 15885 9-30- RENEWAL DATE STATE OF CALIFORNIA

PROJECT DEVELOPMENT

DATE	ISSUED FOR

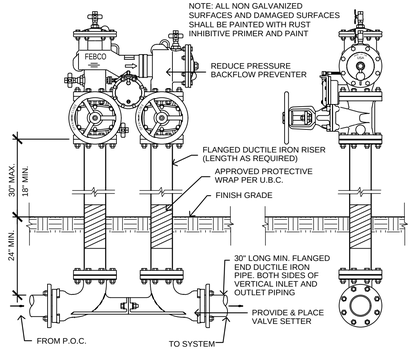
REVISIONS

No.	DATE	DESCRIPTION
1	2.14.23	DISTRICT MODIFICATIONS
2	5.23.23	ADDENDA 5

SHEET DESCRIPTION

OVERALL IRRIGATION PLAN

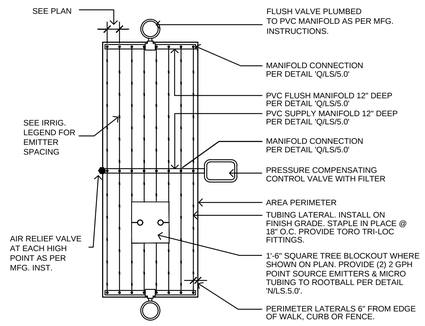
PROJECT COORDINATOR: JOHN SMITH	SHEET No.
PROJECT NO.: 17-67	**LS.1.0**
DATE: 1.27.23	AD4 - L1
SCALE: 1" = 40'-0"	



A LS.5.1 — **BACKFLOW PREVENTION ASSEMBLY**

880NOSYZ

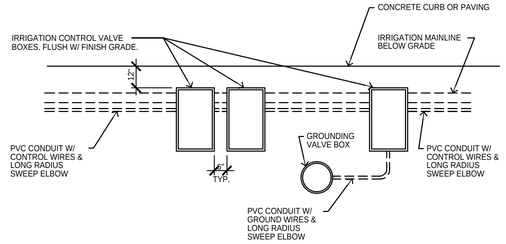
NOT TO SCALE



B LS.5.1 — **DRIPLINE LAYOUT**

GEOLAY

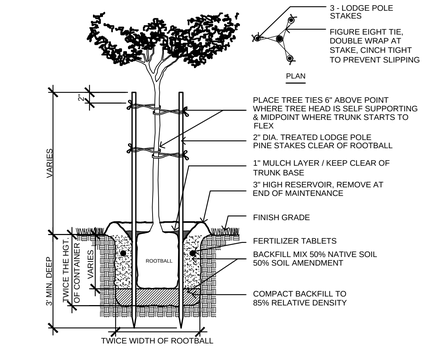
NOT TO SCALE



PLAN

C LS.5.1 — **CONTROL VALVE/GROUNDING LAYOUT**

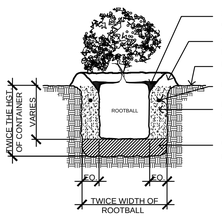
NOT TO SCALE



D LS.5.1 — **TREE PLANTING / TRIPLE STAKE**

3SW00001

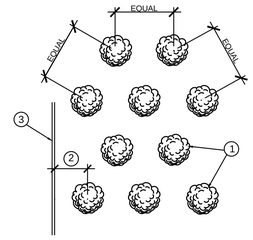
NOT TO SCALE



E LS.5.1 — **SHRUB PLANTING**

SHRUBTYP

NOT TO SCALE



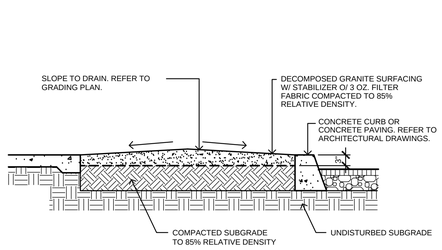
LEGEND

1. LOCATE PLANTS WITH EQUAL SPACING AS INDICATED ON PLAN (TRIANGULAR SPACING.)
2. 1/2 ON CENTER SPACING.
3. PAVING, BUILDING OR HEADER SHOWING PLANTING AREA LIMIT.

F LS.5.1 — **GROUND COVER PLANTING**

GCPLANT

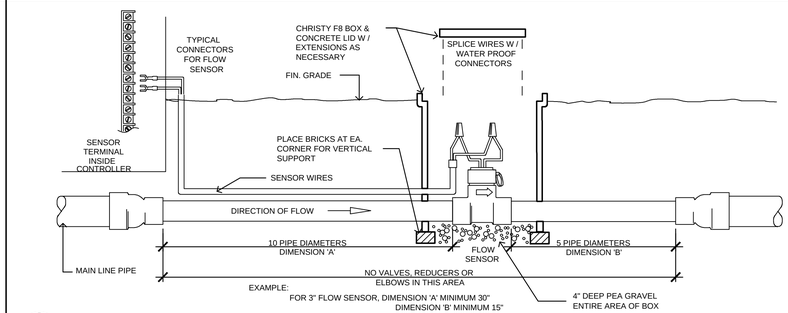
NOT TO SCALE



G LS.5.1 — **DECOMPOSED GRANITE SURFACING**

ROCKDUST 3

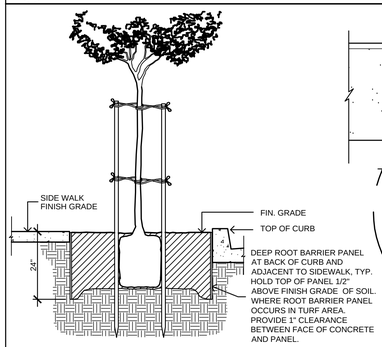
SCALE: 1/2"=1'-0"



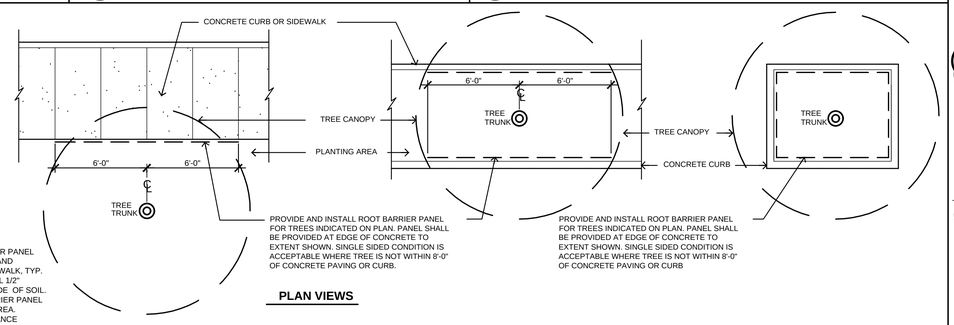
K LS.5.1 — **FLOW SENSOR**

FLOWSENS

NOT TO SCALE



SECTION

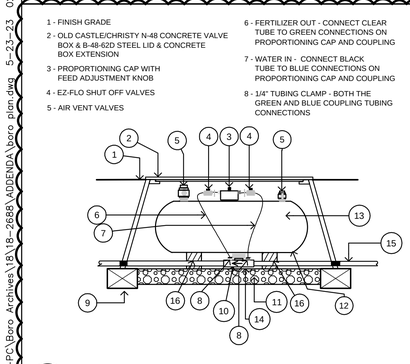


PLAN VIEWS

H LS.5.1 — **ROOT BARRIER INSTALLATION**

ROOT_BARRIER

NOT TO SCALE

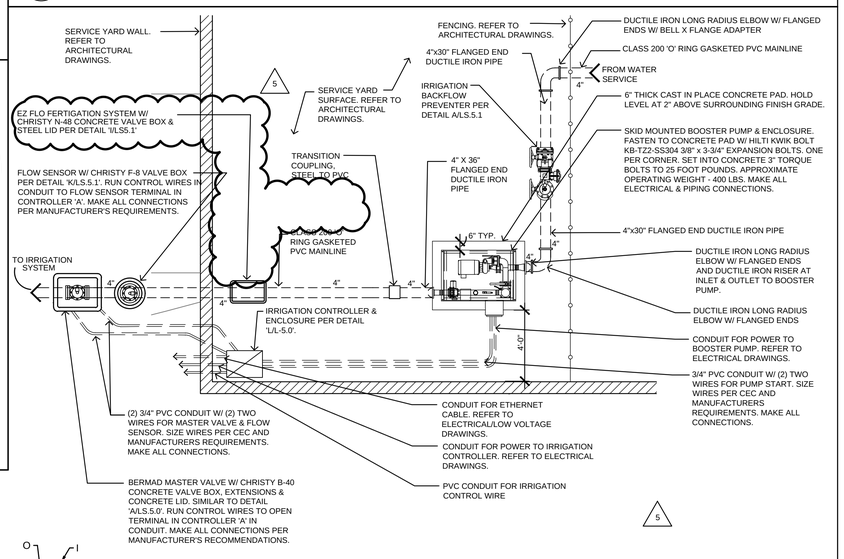


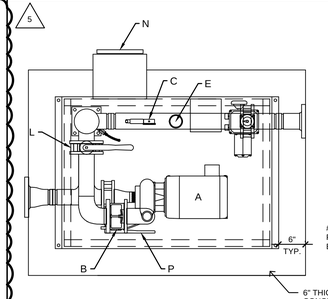
1 - FINISH GRADE
2 - OLD CASTLE/CHRISTY N-48 CONCRETE VALVE BOX & B-48-62D STEEL LID & CONCRETE BOX EXTENSION
3 - PROPORTIONING CAP WITH FEED ADJUSTMENT KNOB
4 - EZ-FLO SHUT OFF VALVES
5 - AIR VENT VALVES
6 - FERTILIZER OUT - CONNECT CLEAR TUBE TO GREEN CONNECTIONS ON PROPORTIONING CAP AND COUPLING
7 - WATER IN - CONNECT BLACK TUBE TO BLUE CONNECTIONS ON PROPORTIONING CAP AND COUPLING
8 - 1/4" TUBING CLAMP - BOTH THE GREEN AND BLUE COUPLING TUBING CONNECTIONS
9 - PLACE BRICKS AT ALL CORNERS OF BOX FOR VERTICAL SUPPORT.
10 - PVC MAIN LINE TO VALVE MANIFOLD
11 - PEA GRAVEL
12 - DRAIN VALVE
13 - EZ-FLO FERTILIZATION SYSTEM. INSTALL IN VALVE BOX TO PROVIDE CLEARANCE FOR TANK DRAINAGE
14 - EZ BALL VALVE CBV 400 COUPLING CONNECTION. INSTALL ACCORDING TO WATER FLOW DIRECTION ARROW
15 - PVC MAINLINE
16 - CONCRETE TANK SUPPORT. PROVIDE 9" OF CLEARANCE FROM BOTTOM OF FERTILIZER TANK TO GRAVEL FOR ACCESS TO DRAIN. PLACE CONCRETE SUPPORTS TO CRADLE TANK & PREVENT TURNING.

NOTE:
ITEMS 3, 4, 5, 6, 7 AND 8 ARE INCLUDED WITH THE EZ-FLO SYSTEM.
ITEM 14 IS PURCHASED SEPARATELY.
PROVIDE MAINLINE MANIFOLDING PER MANUFACTURER'S DETAILS AND RECOMMENDATIONS.

I LS.5.1 — **EZ-FLO FERTILIZING SYSTEM**

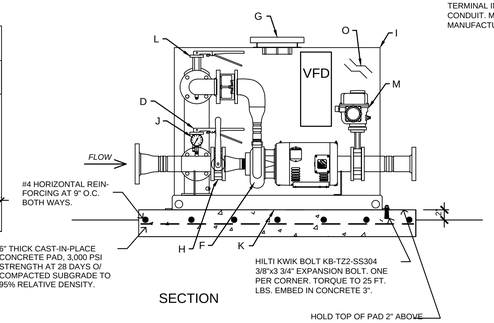
NOT TO SCALE





PLAN

6" THICK CAST-IN-PLACE CONCRETE PAD, 3,000 PSI STRENGTH AT 28 DAYS O/ COMPACTED SUBGRADE TO 95% RELATIVE DENSITY.



SECTION

J LS.5.1 — **BOOSTER PUMP PLAN**

SCALE: 1/4"=1'-0"

PUMP STATION SPECIFICATIONS:
NAME: BRAWLEY ELEMENTARY SCHOOL
STATION MODEL: WMBV-5000-2-15-460-3-300-80
STATION TOTAL PERFORMANCE: 300 GPM @ 80 PSI
DYNAMIC INLET PRESSURE: 37 PSI
BOOST PRESSURE: 43 PSI
REGULATE PRESSURE: 80 PSI
24V PUMP START RELAY CONFIGURATION
PUMP HORSEPOWER:
PUMP NO.1 15HP (3600 RPM)
CHECK VALVE SIZES:
PUMP NO.1 3"
ISOLATION VALVE SIZES:
DISCHARGE ISOLATION VALVE SIZE: 3"
DISCHARGE MANIFOLD SIZE: 3"
EXHAUST FAN REQUIREMENTS: 240CFM

POWER REQUIREMENTS: 460 V, 60 HZ, 3 PHZ, 32 FLA (EST.)

STATION COMPONENTS:
A PUMP AND MOTOR
B CHECK VALVE
C PRESSURE TRANSDUCER WITH GAUGE
D BYPASS VALVE
E FLOW SENSOR
F TEMP SENSOR
G STATION FAN HOOD MOUNTED
H PUMP INTAKE ISOLATION VALVE
I MARINE GRADE ALUMINUM ENCLOSURE (UNPAINTED)
J INLET PSI GAUGE
K STAINLESS STEEL BASE (UNPAINTED)
L PUMP DISCHARGE ISOLATION VALVE
M ELECTRICALLY ACTUATED MASTER VALVE - NORMALLY OPEN
N DEAD-FRONT DISCONNECT PANEL
O INTERNAL SOUND DAMPENING MATERIAL

ROBERT BORO
LANDSCAPE ARCHITECT
P.O. Box 4734
Fresno, California 93744
TEL. (559) 266-4367
FAX (559) 266-3005

REGISTERED LANDSCAPE ARCHITECT — ROBERT L. BORO — C-1781 — EXP. 4/30/25 — STATE OF CALIFORNIA

SIMPBK
7790 NORTH PALM AVENUE
FRESNO, CALIFORNIA 93711
T559.448.8400 - F559.448.8467
www.sim-pbk.com

PROJECT:

SHIELDS & BRAWLEY ELEMENTARY SCHOOL

CENTRAL UNIFIED SCHOOL DISTRICT — Go Green, Every Day!

AD 5-40a
S&B Elementary
02-116800

JOHN H. SMITH, A.I.A. C15885

LICENSED ARCHITECT — JOHN HAMILTON SMITH — C 15885 — 9-30- RENEWAL DATE — STATE OF CALIFORNIA

PROJECT DEVELOPMENT

DATE	ISSUED FOR

REVISIONS

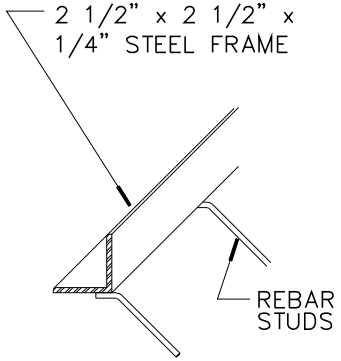
No.	DATE	DESCRIPTION
1	2.14.23	DISTRICT MODIFICATIONS
2	5.23.23	ADDENDA 5

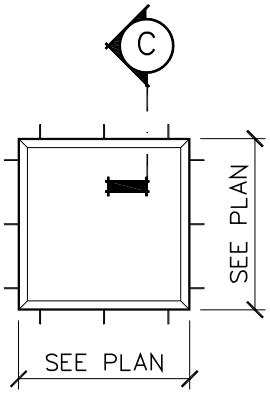
SHEET DESCRIPTION

IRRIGATION & PLANTING DETAILS

PROJECT COORDINATOR: JOHN SMITH	SHEET No. LS.5.1
PROJECT NO.: 17-67	
DATE: 1.27.23	
SCALE: N.T.S.	AD4 - L2

AD 5-41a
S&B Elemenatary
02-116800

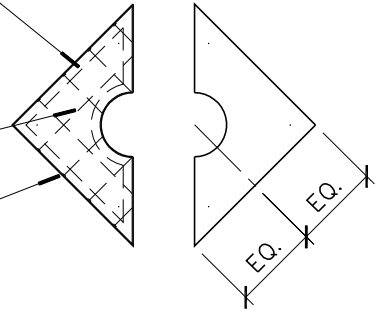


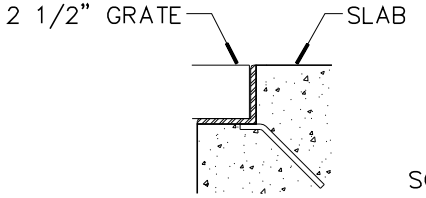


PERIMETER OF EA. COVER (ON 3 SIDES) SHALL HAVE EMBEDDED ANGLE IRON, 2 1/2"x2 1/2"x1/4", PAINTED W/ DEVCON-Z AND SHALL BE WELDED AT CORNERS AND WELDED TO REBAR

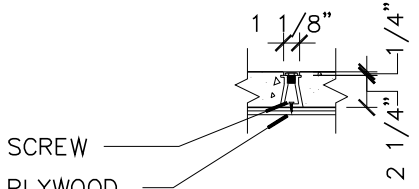
#3 REBAR AT 10" O.C. BOTH WAYS

1"x1"x1/4" SPACERS WELDED TO ANGLE AT 10" O.C.





SECTION C



THREADED INSERT DETAIL

CONCRETE

#3 REBAR AT 10" O.C. BOTH WAYS

ANGLE IRON SHALL BE WELDED TOGETHER AT THE CORNERS TO PROVIDE A RIGID FRAME, W/ ALL SIDES LEVEL

1"x1"x1/4" SPACERS WELDED TO ANGLE AT 10" O.C.

SQUARE TREE WELL

SCALE: N.T.S.